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Mechanical

AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

OCTOBER 2, 1937

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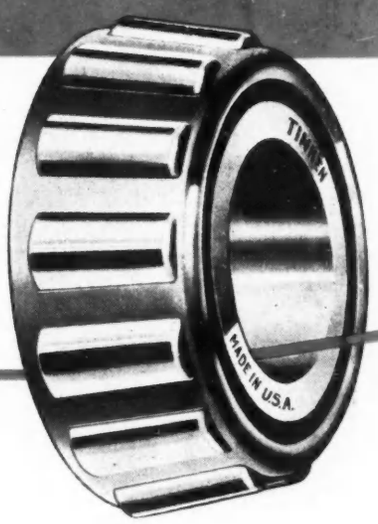

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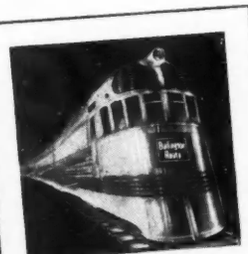

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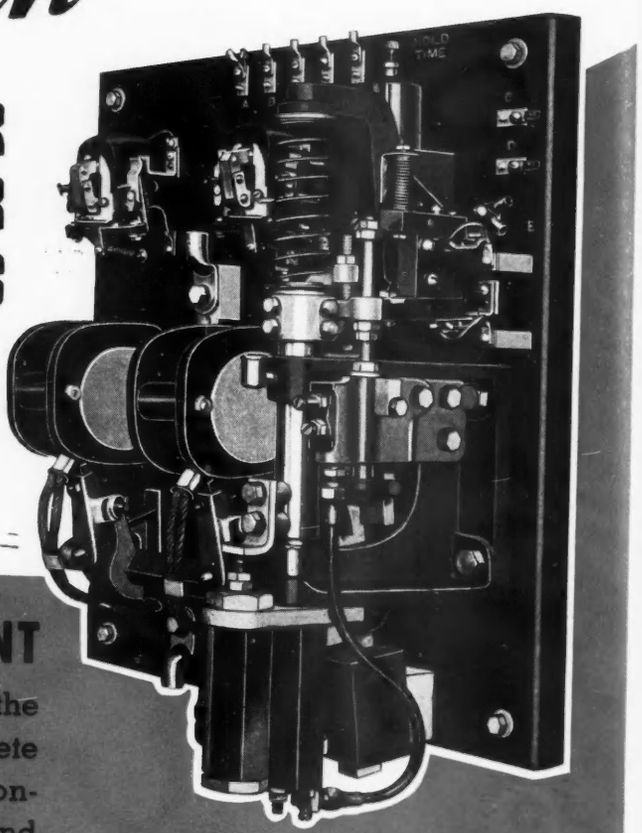

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The AUTOMOBILE

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Published Weekly

Volume 77 Number 14

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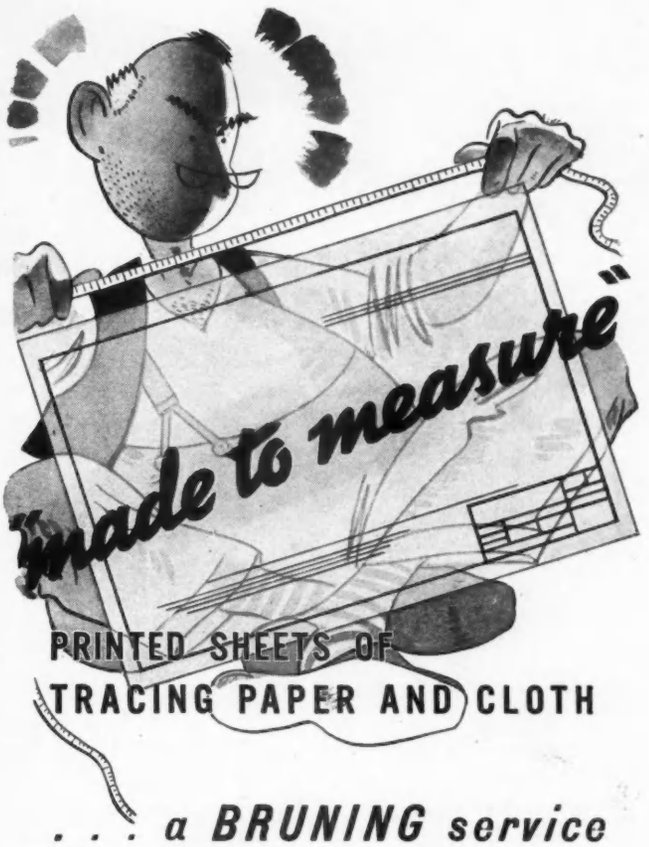

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AUTOMOTIVE INDUSTRIES

October 2, 1937
Vol. 77, No. 14

Plants Iron Out Assembly "Kinks"

Usual Initial Production Troubles Experienced; Some Are Short of Parts; September Output Over 150,000 Cars

Automobile production is definitely on the upgrade again and from now on should gather momentum rapidly in its climb to a near-capacity level before the year is out. It lifted only slightly during the past week after dropping to the year's low point in the week before when most assembly lines were down for change over.

Some of the companies already under way on 1938 model production were having the usual starting troubles and were not progressing as they had hoped. One plant was slowed down by breakage of dies, another by die inaccuracies. Some plants were short of certain parts supplied by outside sources. These were mostly small parts, such as radiator grille, trim or instrument panels. Cars were built and stored at the plants to await final completion, but eventually the difficulties resulted in the slowing down or temporary suspension of assembly operations.

These troubles, however, are the customary kinks in manufacturing when new model production starts, and are usually ironed out in short order. They explain why tentative schedules set up for the first month's run on new models are missed by varying margins. Thus, September production of the industry did not come up to earlier expectations which indicated, on the basis of schedules, in the neighborhood of 175,000 units. Now it appears that upwards of 150,000 units will be nearer the figure representing last month's output. This compares with 139,820 units built in September last year.

The coming week should see a sharp pick-up in production. Plants which experienced difficulties at the start report that their assembly lines are filled up and ready to go at a good rate with their starting troubles behind them. Bolstering the week's output will be the resumption of operations at all Chevrolet branches. Other General Motors divisions are well under way. Chrysler divisions have been operating for a week on new models. Plymouth was the first of the "big three" to start production of 1938 cars and is getting into big volume. Ford assembly operations are not expected to begin until the middle of October, and Graham, which was last to stop producing 1937 models, will be the last to fall into line on 1938 production. Since Sept. 20 all passenger cars coming off assembly lines have been of 1938 vintage.

—H. E. G.

Willys-Overland produced 891 cars in the week ended Sept. 25 and has 2000 scheduled for the final week of the month.

Oldsmobile retail sales during the first 20 days of September totaled 6295, a substantial increase over customer deliveries during the same period of last year, it was stated by D. E. Ralston, general sales manager for Oldsmobile. Retail sales from January 1 through September 20 of this year aggregated 152,918 Ralston said, an all-time Oldsmobile high for that period, which exceeds the corresponding figure for 1936 by a margin of nearly 5000 units.

This Week

NEWS includes prices on a number of 1938 cars, two new car announcments, reports on labor developments, details on the progress of 1938 assemblies, and the story of the break in non-ferrous metal markets. Just as Automotive Industries went to press, word came that domestic copper prices had dropped another cent a pound to 12 cents, making the decline in that metal $40 a ton in three days, one of the widest in history. Tin quotations were also sharply lower.

FEATURED are a description of production at the Cleveland Tractor Co. plant which embodies several unusual operations and mechanical details of the new Packards.

UAW "Purges" Ranks

Many Organizers Discharged; District Heads Named

The long-rumored "purge" of UAW leaders materialized on a big scale during the past week when President Homer Martin announced the dismissal of a dozen organizers from the International's staff. Some of them had been prominent in last winter's strikes. The shake-up swept out of office Frank Winn, publicity director, and his staff, as the entire publicity department was abolished. It is reported that Martin plans to cut the International staff of 200 organizers in two for economy reasons. In the shuffle, new posts were created and a number of new assignments made.

The action has already created a wave of resentment among rank and file members which could well prove serious to the stability of the union. The Flint local sent a delegation to call on Martin to find out "what he is trying to do." A group of about 35 union members representing locals in Detroit, Flint and Pontiac, picketed the hotel where Martin makes his residence, guarding all the exits and insisting on presenting their protests to Martin who asked that the protest meeting be put off. According to a member of the executive board Martin managed to slip out of the building to attend the General Motors conference.

Among the organizers discharged was Victor Reuther, one of the three Reuther brothers who were prominent in the GM strike. Roy Reuther was recently removed from the Flint organizing staff and is awaiting a new assignment. Walter Reuther is president of the West Side Local.

Numerous changes were made in the general staff. Loren Houser was named organizational director for Detroit, succeeding Frankensteen, who is now assistant president. Elmer Dowell, an International representative, was named director of all GM locals in the United States. Announcement had previously been made of the appointment of R. J.

(Turn to page 436, please)

Car Prices Announced

Increases Over 1937 Levels Generally Made

Complete 1938 price lists issued by several automobile manufacturers clearly indicate continuance of the uptrend which began early in August. Prices now being announced are well above those obtaining through July.

Harlow H. Curtice, president of the Buick division of General Motors Corp., announced prices on closed models ranging from $7 to $97 higher than late 1937 prices. Convertible models are raised more. In the two lower priced lines, the increases on closed cars range up to $32. Mr. Curtice remarked that the prices as a whole are

(Turn to page 440, please)

UAW Complains of Plants' Speed-Up

Negotiations With Chrysler, Briggs; Yellow Truck Wage Dispute Settled But Two Suppliers' Plants are Strike-Affected

Complaints of production speed-up at the plants of two major companies in the automobile industry were laid before the managements during the past week by the United Automobile Workers, while the wage dispute at the Yellow Truck & Coach Mfg. Co., Pontiac, was settled. There were strikes at two small supplier plants and an organization drive among Canadian automobile workers got under way.

Union negotiations with officials of the Chrysler Corp. and the Briggs Mfg. Co. were primarily concerned with the speed of production, although in the case of Chrysler the UAW also asked for a 10-cent-an-hour wage increase. A list of grievances is also being discussed. The Briggs discussions followed a dispute over production speed which resulted in the closing of the Mack Ave. Detroit plant during the afternoon shift Sept. 24. The company called it a sit-down strike but union leaders claimed it was a lock-out and maintained that no strike had been called. Other departments continued to work and normal operations were resumed the next day.

The Yellow Truck agreement calls for wages of 80 per cent of the regular rate to production men when they were put on inventory work, with a minimum of 80 cents an hour. The plant closed for inventory Sept. 24 and will resume production Oct. 11. UAW conferences with General Motors management on the matter of contract revision are continuing.

The UAW called a strike at the Michigan Steel Casting Co. plant Sept. 23 after failure to reach an agreement on a new contract to replace one that expired a month ago. The union asks for a closed shop with check-off and a 5-cent-an-hour wage increase, claiming that all but eight of the plant's 350 workers are UAW members. Management insists it is paying top rates to its workers and that a large percentage of the employes are not members of the union. A picket line has been established outside the plant.

A sit-down strike was started at the Commercial Steel Treating Corp. plant Sept. 24 after the management refused the union's demands for a 75 cents an hour minimum for unskilled labor and $1.25 for skilled, the UAW office reported. About 100 employes are said to be on strike.

A membership drive among Canadian workers of Ford, Chrysler and GM plants got under way during the past week. A mass meeting of automobile workers in Hamilton, Ont., Sept. 26 was addressed by Homer Martin, who was to speak again at a Windsor meeting later in the week. C. H. Millard, Canadian organizer, said that he had been named head of a committee to attempt to negotiate a new agreement with GM of Canada.

The UAW executive board which has been in session in Detroit for several weeks has completed its work and a "basis has been laid for stabilizing of the organization both locally and nationally," according to Homer Martin. "Plans have been made to press forward vigorously with the campaign to organize Ford workers. Frankensteen, who has been made assistant president, will also, in cooperation with the president, head the Ford organizing campaign, which will be given major attention during the next few months," Martin said.

"R. J. Thomas, vice president of the UAW, has been placed in charge of the Chrysler organization throughout the country. The setting up of regional offices and district organizations will take place immediately. Organizers for the ensuing year will be appointed or reappointed as rapidly as possible."

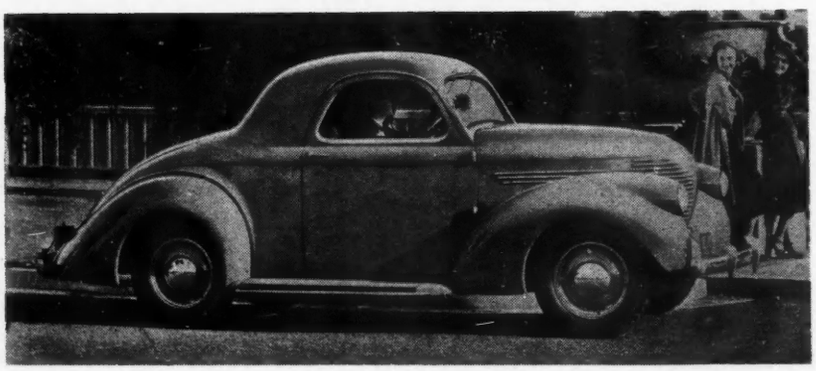
Plant Labor Cost Rise Is Shown

State of Michigan Issues Survey for August Indicating Greater Gain in Payrolls Than in Number of Men Added

Further concrete evidence that the cost of manufacturing automobiles and trucks has gone up more than prices for the product has become available through the State of Michigan's survey of trends in employment and payrolls. Weekly payrolls for August, 1937, in automobile manufacturing plants were 46.8 per cent higher than those a year earlier, partially accounted for by an increase of 25.6 per cent in the number of employees. In automotive parts manufacturing plants August weekly payrolls were 55.8 per cent above those for the same month of 1936, while the increase in the number employed was 27.4 per cent.

Wage costs are one of the two major factors in automobile manufacturing. The other is materials cost. Various materials used in the production of automobiles were 11 to 45 per cent higher in July than they averaged for 1936, and a large part of the rise occurred between January and July of this year. Car prices have already been advanced up to 6.5 per cent (see AUTOMOTIVE INDUSTRIES, issue of Sept. 18).

(*Turn to page 436, please*)



WILLYS coupe for 1938. The line has been improved in detail while the body styling basically follows the design of the cars introduced a year ago. De luxe equipment is now available on both coupe and sedan and new body finishes can be supplied. Low and intermediate gear ratios have been modified to increase flexibility.

Announce Willys Line

De Luxe Models Available; Commercial Units Coming

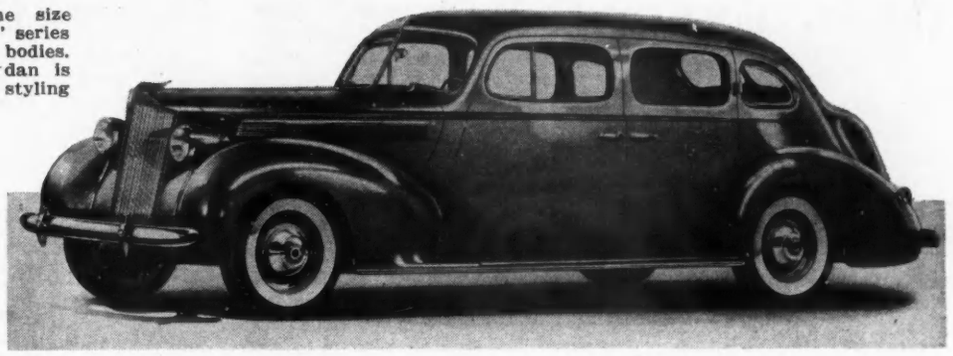
Six models of the Willys passenger car for 1938 are being shown and announcement has been made of the introduction of a commercial pick-up unit for which mechanical specifications are very like those of the passenger line.

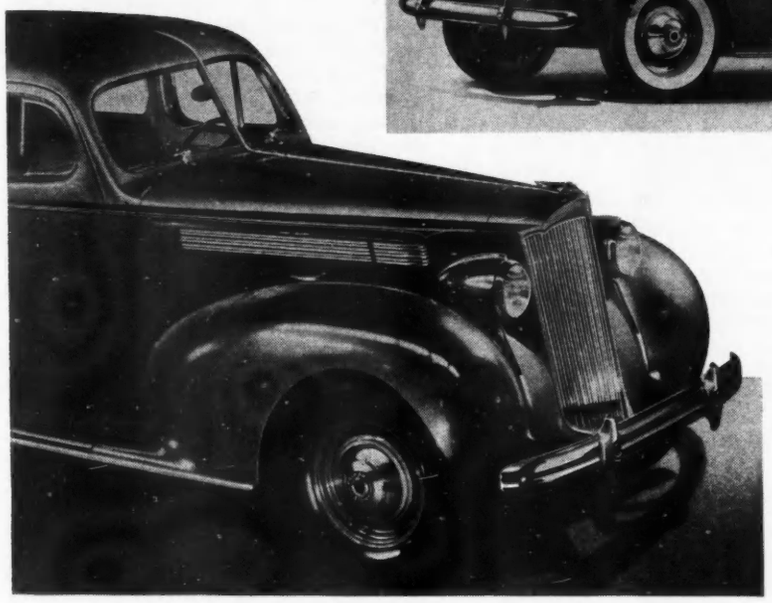
De luxe equipment has been made available on the Willys passenger cars for the coming season, and a number of refinements have been made in the design. Basically however, the new models follow closely the original cars introduced a year ago.

The Willys-built engine, developing 48 hp. at 3200 r.p.m., has a new radiator and the hood has been provided with new hinges and a new seal against dust and heat. Chassis improvements include a lower steering gear ratio, changes in low and intermediate gear ratios to improve flexibility and power on sharp grades, and changes in the brakes to reduce pedal pressure. Battery is located under the hood.

Bodies have a new drip molding, while slight changes have been made in the arrangement of the louvres and in the standard type of finish. Bodies include three sedan types and three coupes, the equipment varying, while there will be a 1000-lb. pick-up and a 750-lb. pick-up in the commercial field.

PACKARD has increased the size of its two "Junior" series cars and has developed new, all-steel bodies. Appearance of the "Six" touring sedan is shown at the right, and the front end styling of the "Eight" below.





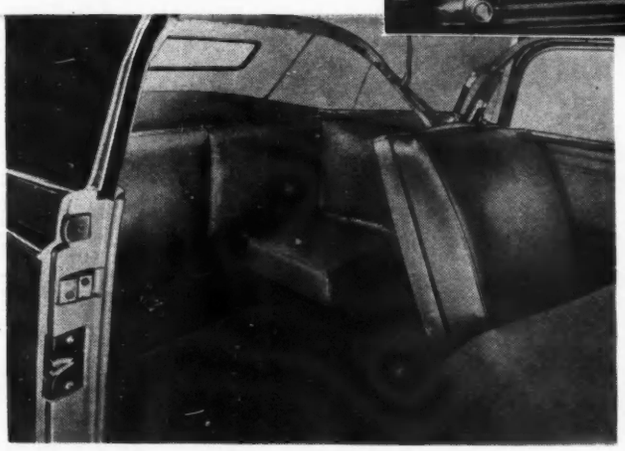
New Packards Ready

7 In. Added to "Junior" Lines: Have All-steel Bodies

Packard will have four lines of cars with 35 different body models for 1938. The lines consist of the "Junior" group of "Six" and "Eight," formerly known as the "115" and the "120," each with seven inches added to the wheelbase making them respectively 122 in. and 127 in., and the "Senior" group of "Super Eight" and "Twelve."

Outstanding improvements in the "Junior" cars include all-steel bodies with seamless steel tops, complete insulation, a new rear spring suspension using especially designed leaf springs said to produce unusually good riding qualities, and the use of a large amount of rubber in separating body and frame to reduce vibration and noise.

Styling changes include the use of split V-type windshields, longer hoods, re-designed fenders and new trim. The characteristic Packard radiator shape has been continued with some refinement of the lines. New interior fittings have been applied and upholstery options have been made available. Front seats have nine different adjustments allowing riding comfort for individuals of virtually any description. There is a new instrument panel with built-in provision for long defrosters and with greatly enlarged package compartments. In coupe and convertible coupe models there are folding "occasional seats" in large compartments behind the front seats which are "straight-across" with divided backs for entrance. When the seats are folded, the baggage space so provided is exceedingly large.



SPACE is ample in the coupe and convertible coupe interiors and in the luggage compartments of the several sedan models. Trunk interiors are fully trimmed and insulated as shown at the right. Arrangement of the folding seats in a convertible coupe is illustrated at the left.

The drive against noise and lack of control over temperatures has led to the use of 11 different kinds of insulating materials including a layer 1 in. thick under the steel roof. Jute and asphaltic compounds are used in various places to deaden sound. A part of the effort to achieve silence has resulted in the mounting of the bodies on special brackets which prevent, through use of rubber, any metal-to-metal contact.

Headlighting has been improved and now is handled through four different beams controlled by a button and a toe pedal. Beam positions are indicated on the dashboards.

Engines are basically unchanged but have been considerably refined to improve performance. A new clutch mechanism is intended to eliminate roughness on engagement.

The rear end suspension involves the use of several materials for controlling the friction between the leaves and the application of a stabilizer or radius rod for accuracy at the rear.

Front end suspension on both "Six" and "Eight" is again the Packard system of independent front springing, including for 1938, however, additional use of rubber between frame and coil springs for improved riding comfort.

The "Super Eights" and "Twelves" have been considerably refined and improved. The former is available on two wheelbases, 134 and 139 in., and the latter on three, 127, 134 and 139 in. There are ten body types available for the "Twelve" and eleven for the "Super Eight." There are also special 148-in. wheelbases offered.

Mechanical details of the new Packard cars will be found on page 458 of this issue.

Plant Labor Costs Up

(Continued from page 434)

Primary reasons for the rise of weekly payrolls by a greater amount than the increase in number of employees are, of course, higher wages and overtime wages paid as working hours shortened. The latter would be particularly true in those cases where a shortage of skilled labor has been felt, resulting in overtime work at high rates.

The detailed figures given by the Department of Labor and Industry of Michigan showed that 68 automobile plants had 274,507 employees on Aug. 15, an increase of 25.7 per cent in a year although employment was down 9.1 per cent from July. Weekly payrolls for August were $9,273,000, an increase of 46.8 per cent in the year but 5.9 per cent below the July levels. In 58 automotive parts plants there were employed 32,565 or 27.4 per cent more than in August, 1936, but 8.5 per cent less than in July. Weekly payrolls for August were $962,689, a gain of 55.8 per cent in the year but 10.4 per cent lower than in July.

Average weekly earnings at automobile plants in the state were $33.78 in August against $32.63 in July and against $28.90 in August of last year.

Perkins on "Wild Cats"

Madam Secretary Says U. S. Will Not "Crack Down" on Labor

Some further clarification of the administration's attitude toward labor disturbances under the Wagner Act was given by Secretary of Labor Perkins just after she addressed an annual convention of insurance agents at Chicago recently.

It is not the plan of the Department of Labor to use any "crack down" methods on labor as a means of preventing "wild cat" strikes, said Madam Secretary, commenting that the term "crack down" is one which "we recently came to learn is not relished by Americans." The term has no legal status in the United States, she said.

Young heads that get hot altogether too easily were blamed by the Secretary for the strike outbreaks which have swept the automobile industry in the past year. She blamed both sides, but she singled out the automobile companies as responsible for not employing more men of middle age and more mature years "as stabilizers."

She said that her department strongly advises labor to avoid wildcat strikes, that contracts between employers and labor are sacred documents and should be carried out, and remarked that wildcat strikes are damaging to organized labor, which workers will learn by experience.

"Most of the wildcat strikes have been engineered by young heads, both in the ranks of labor and their union heads," she said.

Asked by a questioner if her department favored the CIO over the AFL, she replied that her department has "not combined, either individually or collectively, to give the CIO the breaks."

When Madam Secretary was asked concerning the American Federation of Labor's failure to invite her to be a speaker before its annual convention she noticeably straightened up in her chair and her body stiffened. She dismissed the matter with the brief statement that "this is a free country and they are privileged to invite whoever they wish to talk before their convention." She said she probably will not attend any of the AFL convention sessions.

The Secretary of Labor urged higher wages and shorter working hours as the solution to the unemployment problem in the United States. "The human race is not stupid," she declared with positiveness, "and in the next five years we've got to get together to think out the problem of employment and income stability."

New UAW-AFL Dispute

A ruling by an NLRB trial examiner that the UAW union, CIO affiliate, represented a majority of employes in the National Motor Bearing Co.'s Oakland, Cal., plant, despite a closed shop agreement with the A. F. of L.'s International Association of Machinists, is receiving the attention of the full membership of the National Labor Relations Board.

Crux of the incident is that the tool and die workers' membership in the plant is sufficient to give the A. F. of L. union an easy margin in a collective bargain election but counsel for CIO and the board's trial examiner contend that only production employes should be included within the bargaining unit. Counsel for the company and for the A. F. of L. union disagree.

UAW "Purges" Ranks

(Continued from page 433)

Thomas, a vice-president. as director of all Chrysler Corp. locals. Another director for locals outside the "big three" is to be named later. Morris Fields, an executive board member, was placed in charge of all educational activities.

Among those assigned to geographical directorships were Lester Washburn of Lansing, a board member, who engineered last spring's "labor holiday" at the capital. to the post of director for Western Michigan.

The directorship of Eastern Michigan, outside Detroit, went to Charles Madden of Pontiac. This district includes Flint, Saginaw and Bay City. It was announced, however, that for the time being Fred W. Pieper would be chairman of a special five-man committee at Flint and that the committee would work with Madden.

Frank Tucci, board member, was made director of the eastern district with headquarters in New York. Delond Garst, board member, director of the southern and Missouri district with headquarters in St. Louis. Russell Merrill, board member, director of the Indiana and Southern Illinois district, with headquarters at South Bend, Ind., and F. J. Michel, director of the Wisconsin-Minnesota district, with headquarters at Racine, Wis. The West Coast directors will be Irvan Carey, board member, and Richard Coleman, International representative.

For Toledo, Ohio, and its vicinity, Martin named as director Ellsworth Kramer, a board member, and for Cleveland vicinity, Richard E. Reisinger, board member, and John Soltis, former board member.

Nash Dealers to See Cars

Nash Motors, division of Nash-Kelvinator Corp., has completed plans for the showing of its line of 1938 cars to its dealer organization, Oct. 4. The new air conditioning system with which the cars will be equipped will be shown to the field men.

MEN OF THE INDUSTRY

W. H. OLDACRE, manager, D. A. Stuart & Co., Ltd., Chicago, is leaving on a six weeks business trip to England. Mr. Oldacre is well known as one of the leading figures in the field of industrial lubricants and cutting fluids.

JOHN HERLIHY, veteran engineer, pilot and operations official of United Air Lines, has been appointed superintendent of engineering and maintenance by President W. A. Patterson following the resignation of H. O. West, who has accepted a position with Trans-Canada Airlines at Winnipeg.

WILLIAM LOEB, JR., has been elected a member of the board of directors of Reo Motor Car Co., filling the place made vacant by the recent death of his father, William Loeb, Sr.

ARTHUR H. MARKS, formerly an official of the old Diamond Rubber Co., which was absorbed by the B. F. Goodrich Co., and for many years a Goodrich director, has been named vice-chairman of the Goodrich board of directors, it is announced by David M. Goodrich, chairman.

Sees Big Export Year

Stimulated by private initiative and governmental encouragement, automobile ownership in Europe is increasing rapidly, according to George F. Bauer, export manager of the Automobile Manufacturers Association, returning from a four months' trip to study automotive trade conditions in ten of the middle and northern countries of Europe.

A foreign demand for about 650,000 American motor vehicles seems assured for 1937, according to Mr. Bauer who, in addition to his survey trips in the different European countries, was a delegate at meetings of the International Chamber of Commerce.

Buyers' Strike Is Noted

NASFC Told of Trade Bar; Reeves in Address

The recent recessions in trade are nothing more than a purchasing agents' "strike" in protest against what they feel to be unjustifiable advances in material costs, was the view the several hundred delegates gathered from all parts of the country at the fourteenth annual meeting of the National Association of Sales Finance Companies, held Sept. 29 and 30 at the Stevens Hotel, in Chicago. This "strike" is now resulting in price adjustments that will permit business to proceed and develop, they asserted.

Still, a departure at this time from the liberal policies of sales financing that have prevailed during the last three or four years was strongly recommended. Larger down payments and shorter terms, with larger monthly payments were urged, as a means of placing the business in a strongly fortified position, prepared against any possibilities.

In discussing the outlook for the automobile industry Alfred Reeves, vice-president and general manager of the Automobile Manufacturers Association, expressed the wish that manufacturers would exercise greater care in selecting their dealers, with a view to eliminating the shoe-string and unethical operators and increasing the responsibility of their dealer organizations. He said that dealers who have done badly during this year should be educated in merchandising principles and those eliminated whose records show them incapable of serving the industry's best interests and suggested the establishment of a central credit bureau to check on dealers. He recommended that manufacturers "throttle" the enthusiasm of their factory representatives, so that instead of overselling the dealers they sell them only in accordance with actual market surveys. In sales finance, he urged a return to larger down payments and shorter terms. "Conditions are now good enough to permit this," he said, "and it would place the entire industry in a much stronger position."

Five million automobiles and trucks will be sold this year, he predicted, commenting that the truck business is unusually good at this time, and will continue to improve. The forecast was made in spite of his belief that there are several things that will cut volume to some extent, such as price advances and shorter term paper. The automobile industry is an engineer-managed industry, and many improvements of both mechanical and comfort nature will be introduced, he said. Mr. Reeves called attention to the large replacement market which still exists, commenting that nearly half of the 28,000,000 cars and trucks in service lack modern equipment such as four-wheel brakes and safety glass.

The world market for American motor cars is also opening up, said Mr. Reeves. So far this year, 625,000 cars have been sold in 140 different countries, and this foreign movement will expand, he forecast.

Mr. Reeves said that automobile prices will increase an average of 10 per cent over present levels, due to a 10 per cent rise in labor costs with efficiency down 10 per cent or more, plus higher material costs.

Labor troubles, continued Mr. Reeves, will be settled when the automobile industry receives a square deal from labor union managements, after agreements once have been reached. The Wagner Act is very one-sided but will undoubtedly be amended to give employers a larger voice in their own management problems. He said he thought the best thing automobile manufacturers could do for themselves would be seriously to take up personnel work and public relations work so that the public might become more fully acquainted with the manufacturers' problems.

GERMAN STUDENTS who will make a three weeks tour of American highways and motor traffic facilities. The party will also visit a number of automobile factories at Detroit. Seventh from the right is Dr. Ernst Esch, professor of motor transport science, University of Cologne, who heads the tour.

August Registrations

New car registrations for all states and the District of Columbia with the exception of Wisconsin during August amounted to 300,414 as compared with 357,531 in July, and 256,476 during August, 1936. This represents a decline from July of about 16 per cent but is a marked increase over the same period a year ago to 17 per cent. New registrations for the first eight months of the year for the entire country with the exception of Wisconsin amounted to 2,654,301 as compared with 2,457,624 a year ago, an increase of approximately 8 per cent.

APEM Indexes Off

Employment and production indexes of the Automotive Parts and Equipment Manufacturers, Inc., for the four weeks ended Aug. 21 showed declines from the figures for the preceding week but were above the levels of a year earlier. The 48-plant, 40-hour employment index dropped to 112.5 from 119.0 against 87.4 in 1936, while the production index fell to 76.1 from 80.3, against 57.5 in 1936. Comparisons are with 1929 monthly averages.

Study Car Deliveries

Group to Survey Aspects of Highway Use

A special committee representing automobile manufacturers, the National Automobile Dealers Association and the National Automobile Transporters Association will be organzied to review all aspects of the movement of automobiles from factories by highway, both locally and for longer distances, it was announced by J. S. Marvin, chairman of the Traffic Managers' Conference and manager of the traffic committee of the Automobile Manufacturers' Association.

More than half the cars and trucks assembled at factories and assembly plants of member companies move in this way, it was disclosed at a meeting of traffic managers in Detroit, Sept. 23. In 1936 a record total of 2,250,000 cars were handled on the roads. The survey will cover both driveaways and deliveries through the loading of four cars on special trucks. Mr. Marvin said the study is necessitated by reason of the fact that road facilities are affected by many state laws and the fact that supervision is now lodged with the Interstate Commerce Commission when the shipments move in interstate commerce. Use of proper equipment and observance of a uniform code of safe and courteous driving will be sought.

Maximum rail and water shipping facilities will also be used in handling 1938 cars.

Attendance at the meeting included R. L. Reese of Buick, E. J. Tiedeman of Cadillac, E. F. Stewart of Chevrolet, N. J. Brennan of Chrysler, J. Earl Lind of General Motors Truck, C. A. Sullivan of the General Motors Traffic Association, W. H. Lougheed of Graham-Paige, F. W. Whitely of Hudson, M. S. Graham of Reo, J. J. Crimmins of Studebaker, A. M. Tesnow of White, and K. A. Moore and Mr. Marvin, both of the AMA.

Business in Brief

Written by the Guaranty Trust Co., New York

Business Recovers

General business activity during the week ended Sept. 18 recovered from the setback in the preceding week occasioned by the Labor Day holiday. The weekly index of business activity compiled by the "Journal of Commerce" stood at 102.4, as compared with 95.2 the week before and 97.5 for a year ago. One estimate places retail trade during the week under discussion at from 3 to 7 per cent above that in the preceding week and from 8 to 22 per cent above that in the corresponding period last year.

According to the Bureau of Agricultural Economics, farm income during the first eight months of this year amounted to $5,355,000,000, which marks a gain of 15 per cent above that in the corresponding period last year.

The Guaranty Trust Co.'s index of business activity for August stands at the preliminary figure of 96.4, as compared with 95.1 the month before and 86.7 for the corresponding month last year. The company's index of wholesale commodity prices on Sept. 15 was 85.8, as compared with 86.5 a month earlier and 74.5 a year ago.

Railway freight loadings during the week ended Sept. 18 totaled 826,565 cars, which marks an increase of 115,268 cars above those in the preceding week, a rise of 36,708 cars above a year ago, and a gain of 119,745 cars above those two years ago.

Production of electricity by the electric light and power industry in the United States during the week ended Sept. 18 was 12.4 per cent above that in the corresponding period last year.

Food Costs Ease

Retail food costs during the month ended Aug. 17 declined 0.5 per cent, according to the Bureau of Labor Statistics. The index of food costs on that date stood at 85.5, based on the 1923-25 average as 100, as compared with 83.7 a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended Sept. 25 stood at 92.2, as compared with 92.4 the week before and 91.2 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended Sept. 22 showed an increase of $1,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of Government securities remained unchanged. Money in circulation declined $25,000,000, and the monetary gold stock increased $43,000,000.

Automotive Metal Markets

Copper, Lead and Tin Prices Drop; Consumers Wait for Further Decline in Latter; Large Steel Orders Still Slow

Artificiality, which for some time had made non-ferrous metal markets top-heavy, was lessened when copper producers and custom smelters announced early in the week beginning Sept. 27 a reduction in the price of the red metal to 13 cents a pound, after it had been quoted at 14 cents for exactly five months. The $20 per ton cut followed sales in the "outside" market at as low as 12¾ cents.

The highest price this year was 17 cents, which became effective on March 31, followed a brief week later, by the first of four successive reductions. The so-called export price, at one time this year 17½ cents, was down to 12⅞ cents at the beginning of the week. For some time this quotation, more an approximate conversion of the London Metal Exchange price than an indication of the actual price paid in export transactions, had been on the downtrend and in view of the lagging demand from domestic consumers exerted a depressing effect out of all proportion to its importance, when the 4-cent-per-pound protective duty on imports and home consumption nearly three times as high as exports were taken into consideration.

The dip in the price of copper, chiefly under the influence of the recession at London, serves as a reminder that the price of the red metal is no longer made here, as was once the case, but due to the much heavier production of Canada and South Africa, in London.

Price reductions of ½ to 1 cent per pound in the price of copper and brass products and of $10 a ton in scrap allowances followed announcement of lower copper prices.

Although consumers had for a few days extended good support to the tin market at upwards of 59 cents for spot Straits, reaction in Singapore and London on Sept. 27 sent the price here down to 57⅝ cents. There was a time when 2½ pounds of American copper would buy a pound of Straits tin. Then the ratio widened and became three and later four pounds of copper to equal the price of a pound of tin. Now it is between four and five times, and a good many consumers feel that tin is selling way out of line with other metal values, due chiefly to arbitrary control of output by the International Tin Control. With speculative interest in the metal rather thin since armament needs are no longer held out as bait, most consumers feel that they have nothing to lose by waiting for a price recession, which they believe is long overdue.

Improved operating rates of steel mills catering to automotive consumers are indicated by this week's gains in the Detroit and Cleveland districts, although none of the tonnage business expected from the large automobile manufacturers appears to have been placed so far. Round tonnages of foundry and malleable pig iron, however, have been ordered by automotive foundries. Prices are unchanged all along the line and talk of impending revision meets with stout denials from producers.

Price declines in other metals came upon a dull market in lead, with the result that two successive reductions of $5 a ton each were announced by leading marketers to stimulate sales. Zinc also drooped, and smelters were unable to obtain bids from consumers. Although plant extensions by some of the secondary aluminum producers reflect confidence in the early revival of buying by automotive consumers, little market activity is noted at this time.

Convention Plans

Dates for the sixteenth annual convention of the Automotive Engine Rebuilders Association have been set for June 20-23, 1938, at Detroit, Mich. Present plans are to hold a three-day technical session with the fourth day devoted to visiting local automobile factories.

Accident-Free

The Hagerstown Perfect Circle plant with the completion of 1,160,000 man-hours without a lost time accident during the year from July 1, 1936 to July 1, 1937, has won second place in the National Safety Council's contest.

. . . *slants*

COMPARISON—*Chevrolet Motor division of General Motors reports that it used in a year, in the forge, spring and bumper plant alone, over 700,000,000 lb. of steel. For comparison, the company states that the new Golden Gate bridge at San Francisco, of which the center span is 4200 ft. long, required 200,000,000 lb. of steel in its construction.*

STARTING AN ARGUMENT—*Men drivers are better equipped than women to cope with emergencies resulting from blow-outs, but are more apt to run the danger of blow-out accidents because of the greater speed at which they drive, according to surveys recently completed. Preliminary tests of 10,000 men and women drivers conducted by the American Automobile Association show that men as a rule have three advantages over women, which expert test drivers say would be in favor of men in case of a blow-out. These advantages are: greater strength, quicker reaction time, and less disturbance caused by sudden noises.*

Proof that the average man drives faster than the average woman was found in the AAA survey, which disclosed that men drivers claimed an average of 47.4 m.p.h. on the road, while women drivers claimed an average of 44.7 m.p.h.

ROAD PROBLEM—*Increased use of tar on roads throughout the country is causing the water supplies of hundreds of cities to take on objectionable tastes and odors, reports the American Institute of Sanitation. Road tar contains small amounts of phenolic chemicals which are leached out by the rain and carried along to the lakes, rivers and reservoirs from which cities obtain their water supplies. The chemicals washed out from tarred roads by the rain are usually present in very small amounts and ordinarily are unnoticeable to the*

taste. But when the water is chlorinated the phenolic substances are turned into pungent compounds having a pronounced medicinal taste. Just a few drops of the phenolic leachings from tarred roads will render a million gallons of water undrinkable after chlorination. It is now possible, however, to remove the objectionable tastes and odors in public water supplies that arise from tarred roads and other causes, says the institute. Scientists have perfected a purifier, activated carbon, which takes out such disflavors in water. Its action is not chemical, but mechanical like a magnet, attracting and holding the undesirable tastes and odors. It does not dissolve in the water and adds nothing to it, says the institute.

August Linage

August automotive newspaper lineage was below that for July, but 9.4 per cent above August, 1936, according to *Editor & Publisher*. This was only the second month of the year to pass the corresponding 1936 month. The August gain was sufficient however, to raise the linage for eleven months of the 1937 model year over the total for the preceding model year, but for 8 months of the calendar year the linage was 5.5 per cent under 1936.

Company Earnings

Hayes Body

Hayes Body Corp. reported for the quarter ended July 31 net income, after charges excepting provision for Federal taxes, of $34,289, against a net loss of $48,825 for the same period in 1936.

Monroe Auto Equipment

Monroe Auto Equipment Co. reported net income for the eight months ended Aug. 31 of $55,982 or 43 cents per share.

Nachman Spring-Filled

Nachman Spring-Filled Corp. reported for the year ended June 19 net income of $197,637 or $2.26 a share, against $143,221 or $1.64 a share for the preceding fiscal year.

New Britain Machine

New Britain Machine Co. reported for the period Jan. 1 to Aug. 14 net income of $363,279 or $4.04 per share.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Second Milestone

This issue marks the close of our second year of publication. It has been a year of financial stringency in the United States, a year when old-established industries have felt the pinch and when a new industry, such as we have undertaken to promote, must necessarily have suffered for want of capital . . .

Americans who have traveled abroad of late, have returned with a strong faith in the future of the motor vehicle, and a desire to see it adopted on this side of the Atlantic. These act as advocates and defenders of the new locomotion among our countrymen, and are eligible as investors or purchasers . . .

To our readers, who have patiently followed us through all the delays and disappointments incidental to the inception of a new industry, we extend our thanks, and our congratulations at the perseverance and good judgment they have shown in standing true to the cause of what is destined to be the greatest industry of modern times . . .

From *The Horseless Age*, Oct., 1897.

Plan Army Air Research

All research projects and special studies bearing on the development and safety of aeronautics and conducted or supervised by the Bureau of Air Commerce are now coordinated under the Safety and Planning Division recently created under the reorganization plan for the bureau. Richard Gazley, formerly chief aeronautical engineer, has been appointed chief of the new division.

The powerplant section will seek to determine the hazardous factors in powerplants and will attempt to find means of reducing those hazards. It will also keep in close touch with new powerplant developments and foster them whenever advisable and possible. The following are specific projects:

1. Supervision of an existing contract for a barrel-type engine.
2. Endurance test of Funk engine.
3. Study of powerplant vibration and development of means and recommendations as to the application of such means for the prevention of propeller failures resulting from vibration.

John H. Geisse, who has been appointed chief of the powerplant section, served as assistant chief, powerplant section of the Army Air Service at McCook Field, Dayton, Ohio, from 1919 to 1821, after serving as a pilot throughout the period of hostilities. He also held the posts of experimental engineer, Wright Aeronautical Corp., chief engineer, aeronautical engineers laboratory of the Naval Aircraft Factory; and vice-president and chief engineer of the Comet Engine Co.

August Truck Output New Record

(U. S. and Canada)

Passenger Car and Truck Production

	August 1937	July 1937	August 1936	Eight Months 1937	Eight Months 1936
Passenger Cars—U. S. and Canada:					
Domestic Market—U. S.	299,496	341,192	200,831	2,777,270	2,486,110
Foreign Market—U. S.	11,960	19,211	8,520	181,547	136,625
Canada	5,814	12,513	2,789	115,150	95,655
Total	317,270	372,916	212,140	3,073,967	2,718,390
Trucks—U. S. and Canada:					
Domestic Market—U. S.	64,506	61,175	52,776	530,054	484,367
Foreign Market—U. S.	18,360	17,390	9,147	133,268	93,463
Canada	4,928	5,428	1,871	42,104	25,428
Total*	87,794	83,993	63,794	705,426	603,258
Total—Domestic Market—U. S.	364,002	402,367	253,607	3,307,324	2,970,477
Total—Foreign Market—U. S.	30,320	36,601	17,667	314,815	230,088
Total—Canada	10,742	17,941	4,660	157,254	121,083
Total—Cars and Trucks—U. S. and Canada	405,064	456,909	275,934	3,779,393	3,321,648

*August truck production sets new peak for the month.

Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)

	Eight Months 1937	Eight Months 1936	Per Cent Change	Per Cent of Total 1937	Per Cent of Total 1936
Under $500	1,463,426	1,503,105	− 2.6	47.61	55.30
$501 to $750	1,484,383	1,098,063	+35.2	48.29	40.39
$751 to $1000	92,758	81,331	+14.0	3.02	2.99
$1001 to $1500	23,130	26,175	−11.6	.75	.96
$1501 to $2000	7,898	6,517	+21.2	.26	.24
$2001 to $3000	2,242	2,946	−22.6	.07	.11
$3001 and over	130	253	−48.5	...	.01
Total	3,073,967	2,718,390	+13.1	100.00	100.00

Truck Production by Capacities

(U. S. and Canada)

	Eight Months 1937	Eight Months 1936	Per Cent Change	Per Cent of Total 1937	Per Cent of Total 1936
1½ Tons and less	660,751	563,317	+17.3	93.67	93.38
2 to 3 Tons	26,762	26,945	− 0.6	3.80	4.47
3½ Tons and over	9,000	5,587	+61.0	1.27	.93
Special and buses	8,893	7,409	+20.0	1.26	1.22
Total	705,426	603,258	+17.0	100.00	100.00

1938 Car Prices Announced

(Continued from page 433)

"lower than were generally anticipated."

Following is the complete price list for 1938, fully equipped, delivered at Flint, Mich., with comparisons against late 1937 prices:

Buick

Series 40

	1938 Prices	1937 Prices
Convertible phaeton	$1406	$1313
4-door touring sedan	1047	1021
2-door sport sedan.	981	959
Business coupe ...	945	913
Convertible coupe (rumble seat) ...	1103	1068
Sport coupe (opera seat)	1001	975
4-door sport sedan	1022	995
2-door touring sedan	1006	985
Series 60		
Convertible phaeton	1713	1570
4-door touring sedan	1297	1266
Convertible coupe ..	1359	1314
Sport coupe (opera seat)	1226	1219
4-door sport sedan.	1272	1240
2-door touring sedan	1256	1230
Series 80		
Convertible phaeton	1983	1862
Touring sedan	1645	1553
Formal sedan	1758	1675
Sport sedan	1645	No comparable 1937 model
Series 90		
8-passenger touring sedan	2350	2254
Limousine	2453	2356
6-passenger touring sedan	2176	2080

Willys

Passenger

	1938 Prices	1937 Prices
Economy coupe	$499	$....
Standard coupe	525	491
De luxe coupe	579	535
Standard sedan	573	545
De luxe sedan	624	590
Custom sedan	715	....

Commercial

750 lb. capacity Economy light delivery pick-up	$480
½ ton capacity stripped chassis without cowl or cab	330
Same with cowl	400
Cab chassis	490
½ ton pick-up complete with enclosed cab and all accessories	530

All prices complete at Toledo except for Federal and other taxes, and handling charge.

Packard**

Delivered prices at the factory, including standard equipment and all charges except freight and state tax.

Six—1600

	1938 Prices	1937 Prices
Touring sedan, 4d..	$1175	$1075
Touring sedan, 2d..	1145	1025
Club coupe	1120	1005
Conv. coupe, 2-4p...	1235	1075
Business coupe	1075	960
Chassis	810	....
Eight—1601		
Touring sedan, 4d..	$1325	$1250
Touring sedan, 2d..	1295	1235
Club coupe	1270	1175
Conv. coupe, 2-4p...	1365	1250
Conv. sedan	1650	1550
Business coupe	1225	1130
Chassis	960	....
Eight—De Luxe—1601-D		
Touring sedan	$1540	....
Eight—1602		
Touring sedan, 7p..	$1955	....
Touring limousine..	2110	....
Super-Eight—1603		
Touring sedan, 4d..	$2790	$2630
Chassis	2090	....
Packard, Continued		
Super-Eight—1604		
Formal sedan	$3710	$3550
Touring sedan, 4d..	2995	2835
Club sedan	2990	2830
Coupe, 5p.	2965	2810
Coupe, 2-4p.	2925	2715
Conv. coupe, 2-4p...	3210	2980
Victoria	3670	3460
Chassis	2170	....
Super-Eight—1605		
Touring sedan, 7p..	$3165	$3010
Touring limousine..	3305	3145
Convertible sedan ..	3970	3665
Chassis	2230	....
Twelve 1607		
Formal sedan	$4865	$4655
Touring sedan, 4d...	4155	3940
Club sedan	4255	4015
Coupe, 5p	4185	3970
*Coupe, 2-4p	4135	3920
*Conv. coupe, 2-4p.	4370	3950
*Victoria	5230	5014
Chassis	2950	....
Twelve 1608		
Touring sedan, 7p..	$4485	$4270
Touring limousine ..	4690	4475
*Conv. sedan	5390	5175
Chassis	3140	....

* Six-wheel equipment, all others five-wheel.

** Prices published in AUTOMOTIVE INDUSTRIES, issue of Sept. 25 included Michigan sales tax of 3 per cent.

Cadillac

Delivered prices at factory

V8—60—127 in. wb.

	1938 Prices	1937 Prices
*Touring sedan, 5p..	$2085	$1760
V8—65—132 in. wb.		
*Conv. sedan, 5p....	$2600	$....
Touring sedan. 5p..	2285	....
Tour. sedan, 5p.(Div.)	2360	....
V8—75—141 in. wb.		
Conv. coupe, 2p....	$3380	$....
Conv. sedan, trunk.	3940	3730
Coupe, 2p.	3275	....
Coupe, 3-5p.	3380	....
Town sedan, 5p....	3635	3425
Touring sedan, 5p..	3075	2915
Touring sedan	3155	....
Formal sedan, 5p...	3990	3785
Formal sedan, 7p...	3990	....
Touring sedan, 7p..	3205	3070
Livery sedan. 8p...	3105	2845
Imp. tour. sedan. 7p	3360	3270
Liv. imp. tour., 8p..	3255	3050
Town car. 7p.....	5115	4855
Sixteen—90—141 in. wb.		
Conv. coupe	$5440	$....
Conv. sedan, trunk.	6000	....
Coupe, 2p.	5335	....
Coupe, 5p.	5440	....
Town sedan	5695	....
Touring sedan	5135	....
Touring sedan (Div.)	5215	....
Formal sedan, 5p...	6050	....
Formal sedan, 7p...	6050	....
Touring sedan, 7p..	5265	....
Imp. tour. sedan, 7p.	5420	....
Town car. 7p.....	7170	....

*Five wheel equipment, all other 6 wheel.

La Salle

Delivered prices at factory

Series 38-50	1938 Prices	1937 Prices
Convertible coupe ..	$1415	$1350
Convertible sedan ..	1390	1680
Coupe	1300	1155
Touring sedan, 2d..	1340	1275
Touring sedan, 4d..	1380	1320

Plymouth Holds Preview

Plymouth division of Chrysler Corp. held a tenth anniversary dealer preview of its 1938 cars in Detroit, Sept. 30. Public announcement of the cars is scheduled for late in October.

The Plymouth plant was stated to be approaching normal operations after the initial production of pilot cars. Output is expected to rise quickly both in Detroit and at branch assembly plants at Evansville, Ind., and Los Angeles, according to D. S. Eddins, president of the division.

Headlight Testing

Two automobile manufacturers have announced programs to enhance highway safety through headlight service. This follows announcement by the Automobile Manufacturers Association, cooperating with the Automotive Safety Foundation, of a drive in the direction of improved headlighting.

T. W. Moss, general service manager for Chrysler Corp. car divisions, announced that headlight checkup would be made part of the safety inspections which are being handled in connection with car servicing.

C. P. Simpson, general sales manager, Pontiac division of General Motors Corp., stated that headlights lose efficiency with lack of care, commenting that cleaning may increase candlepower as much as 100 per cent. He urged the use of modern testing devices and said that Pontiac is offering special courses to service men and students in headlight testing and adjusting.

Radio "Hobby Lobby"

"Hobby Lobby," under the sponsorship of the Hudson Motor Car Co., for Hudson and Terraplane cars, will bring to the microphone men and women from all sections of the country who will describe their leisure-time activities, with Dave Elman, authority on hobbies for pleasure and profit, in charge. The series will be heard over a coast-to-coast Columbia Network of 71 stations every Wednesday from 7.15 to 7.45 P. M., beginning October 6. Brooke, Smith & French, Inc., Detroit, is the agency.

Plant Notes

Variety of New Facilities Provided in Country

A new $3,000,000 plant of E. I. duPont de Nemours & Co. near Baton Rouge, La., is now manufacturing the first Ethyl fluid ever made outside of Deepwater, N. J. A second unit of the plant is now under construction and will cost $2,000,000. The lately completed units has a fourth of the capacity of Deepwater, N. J., plant and the second unit, to be finished early in 1938, will have a like capacity. The Ethyl Gasoline Corp. is owned jointly by the Standard Oil Co. and the General Motors Corp. The plant is built on 50 acres of land leased from the Ethyl Gasoline Corp. and is the property of the duPont company, which operates the plant.

W. C. Dunn, president of the Ohio Crankshaft Co., announces that construction is well under way on the company's new plant at Cleveland. The new plant, located approximately one mile from the present plant on Clement Avenue, will provide 75,000 sq. ft. of floor space in a building 500 ft. x 150 ft. on an 18-acre site. The cost of the land and building totals $300,000. New equipment to be installed will cost an additional $400,000. Included in the new plant is a $100,000 laboratory for research on the Tocco process. The remainder of the plant will be de-

voted to the manufacture of crankshafts and Tocco-hardening operations. New heavy equipment will be installed for machining and Tocco-hardening crankshafts weighing up to 2000 lb., such as those used in large Diesel engines for locomotives. Upon completion of the new plant, operations in the present factory will be expanded for manufacturing Tocco-hardening installations. Over 400 men are now employed by the company and an additional 300 will be put to work when the new plant is completed.

Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. J., is building an addition to its plant to provide more space for its laboratory staff. Two laboratories are separately maintained. One is devoted to cellulose-type finishing materials and the other is the synthetic and oil base unit.

G. S. Blakeslee & Co., manufacturers of degreasing machines and metal parts washers, have begun construction on a two-story addition to the plant at Cicero, Ill. The addition will add 50 per cent to manufacturing floor space and will double office space.

E. I. du Pont de Nemours & Co. will build a plant at Fort Madison, Iowa, to supply industrial finishes. Du Pont has acquired land and buildings idle for 15 years but suitable for reconditioning which will be supervised by the company's own engineers. There are at present no du Pont facilities for the production of the finishes between Chicago and the Pacific Coast.

A line of fender presses heads a list of press plant improvements in De Soto's new factory that will double the variety of sheet metal flow through the plant this year. At the same time, the daily volume of sheet metal handled by the plant will be increased almost 50 per cent, De Soto officials stated. The new fender line includes five presses. The largest press is a double-crank toggle drawing press weighing almost 400,000 lb. and capable of 1,000,000 lb. of pressure on the plunger. This press measures 132 in. between uprights and is 90 in. deep from front to back. A new type of roller-leveler has been placed in front of the fender line to prepare the metal for the drawing and trimming operations.

Pittsburgh Plate Glass Co., in a letter to stockholders accompanying Oct. 1 dividend checks, reported the acquisition of the plant and business of the Thresher Varnish Co. of Dayton, Ohio, resulting in a source of supply for industrial paints. The company also announced the near-completion of plant additions at Milwaukee, Detroit, Newark, N. J., Los Angeles and Portland, Ore.

Packard Motor Car Co. expenditures in preparation for 1938 production will amount to $13,000,000, completing a four-year program costing over $29,000,000.

TOOLS OF TOMORROW

Fine-Pitch Gears

. . . can be burnished two at a time on new type Fellows equipment

Small, fine-pitch gears can be burnished two at a time on a new type gear burnishing machine recently placed on the market by the Fellows Gear Shaper Co., Springfield, Vt. Features of the equipment include: An electrical arrangement making it impossible to bruise the teeth of fine-pitch gears (burnishing pressure cannot be applied until the work and burnishing gears are in rotative contact); use of four idler and one driven burnishing gear which make it possible to burnish two gears at a setting; independent operation of slides carrying idler burnishing gears which permits burnishing of two gears of different diameters at the same setting.

Idler burnishing gears are held by adjustable studs on slides, the position of which relative to the driver burnishing gear is controlled by a cam and adjustable cam bars. The cam and cam bars are used to set the slides so that the gears to be burnished, when in the loading and unloading position, are in mesh with the burnishing gears with sufficient backlash to permit easy insertion and removal of the work. When the operating lever is shifted to the burnishing position, the cam is relieved from the cam bars, allowing weights at the rear of the machine to apply the necessary burnishing pressure.

Fellows machine for burnishing small, fine-pitch gears. (insert) Close view of burnishing gears and operating slides showing two gears of different diameters being burnished at the same setting.

The work, when being burnished, is supported on studs which locate it in proper relation to the burnishing gears. For the ordinary run of work, these supports are held in adjustable bars located in the slides. For very small gears, special supports are attached to the slides. In burnishing helical gears, adjustable swinging supports are employed to prevent endwise movement of the gears when burnishing pressure is applied.

Time of burnishing is controlled automatically by adjustable timing relays having a range of 3 to 40 sec. These relays are independently adjustable, permitting burnishing for a longer time period in one direction than in the other, if desired.

With this machine, gears of 4-in. diameter, 1/16-in. face width can be handled at the rate of 480 per hr., and smaller gears at a proportionately faster rate. Maximum capacity is 4-in. pitch diameter, 20 diametral pitch.

Oilfilt'eer—Correction

In the description of the Oilfilt'eer in our issue of Sept. 18, it was incorrectly stated that the case is made of pressed steel. It is made of aluminum, die-cast, with baked-enamel finish.

AUTOMOTIVE ABSTRACTS

Shrink-Fit Data

Although considerable data are available on shrink-fits for steel and iron parts, such data for fits between aluminum and steel or iron parts are comparatively scarce. Examples of such fits include the fixation of aluminum heads to steel cylinders of air-cooled aircraft engines and the fitting of valve-seat inserts and spark-plug bushings in aluminum cylinder heads of automobile and aircraft engines. As far as calculation of the necessary interference is concerned, the case of a thin-walled ring is the simplest. As regards loosening of the fit during an increase and tightening during a decrease in temperature, the effect, of course, is the greater the difference in the coefficients of expansion of the two metals, the greater the change in temperature, and the larger the diameter of the seating surface.

In order to obtain a secure fit, the play or clearance on insertion of the ring must be made as small as possible. A distinction is made between two different classes of fit, referred to as the precision sliding fit and sliding fit. Following are some figures which are applicable to all metals:

Diameter of seating surface	Diametral clearance Precision sliding fit	Sliding fit
0.500 in.	0.00024 in.	0.00048 in.
1.000	0.00030 in.	0.00060 in.
3.600	0.00050 in.	0.00104 in.
6.000	0.00060 in.	0.00128 in.

The play depends on the precision of the machining operation. For this reason, owing to the higher precision in the counterbore for the valve-seat insert in aluminum heads, a smaller play may be expected than in the case of cast iron heads.

The effect of the shrinkage naturally varies with the diameter, but for equal diameters the shrink-fit allowance must be increased with the forces which tend to displace the part held in place, as well as with the variations in temperature which may be expected. For small rings, subjected to moderate displacement forces, an interference of 0.0005 to 0.001 in. is generally allowed for diameters of less than 0.6 in., and 0.0016 in. for diameters between 0.6 and 1.0 in. In the case of valve-seat inserts in aluminum heads, which range in diameter from 1.6 to 2.6 in., and which are subjected to wide variations in temperature, there have been adopted interferences of 0.006 and 0.012 in.

The following figures, which were obtained in the course of experiments on valve-seat inserts of automobile engines, give an idea of the forces required to remove the seats from their lodgings. The inserts were made of aluminum bronze with a smooth outer surface and were put in place in the aluminum head by contracting them in a bath of liquid nitrogen:

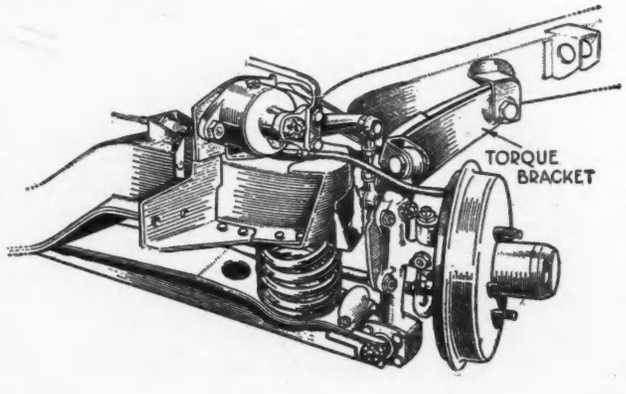
Interference	0.0056-0.0064 0.0072-0.0080	0.0064-0.0072	
Force required for removal	1960 lb.	2290 lb.	2280 lb.

Aluminum alloys when subjected to temperatures between 200 and 750 deg. F., are subjected to a permanent growth, and this may interfere with shrinkage operations such as that of the insertion of valve seats, when operating at rather high temperatures, say 575 deg. F. It is an advantage of the Y alloy that with it this permanent growth is negligible. For silicon alloys the growth is moderate, while in the case of copper alloys it is relatively high. For the latter it may attain 0.001 and in exceptional cases 0.002, the first of which figures is equal to the "reversible" thermal expansion due to a temperature difference of 70-90 deg. and the second to 145-180 deg. F.

For the purpose of making shrink fits, aluminum blocks may be heated in an oil bath to from 300-450 deg. F. This process is open to the objection that the block generally has to be cleaned after the operation, and there is also an appreciable loss of oil. Heating in a lead bath is sometimes practiced, but in the case of aluminum this has the disadvantage that at the high temperature of approximately 750 deg. F., serious permanent deformations occur and one does not obtain the calculated interference. For instance, in the case of a diameter of 4.6 in., instead of a calculated 0.012, one obtains only 0.008 in.—*Revue de l'Aluminium* for July-August.

New English Daimlers With Independent Front Springing

A new model announced by the Daimler Motor Co., the Daimler 15, differs from its predecessor chiefly in having front independent springing. The suspension adopted is an adaptation by Daimler engineers of a system patented by Andre Girling. It consists of two beams per wheel, one of which is transversely mounted relative to the longitudinal axis of the car, while the other is parallel to the frame side rail. A rather soft coil spring is interposed between the frame and the transverse member, and the vertical motion of the wheel is controlled by this beam and by a short parallel link above the frame. The longitudinal arm locates the wheel in a fore-and-aft direction and also takes the braking torque on the wheel. A large hydraulic shock absorber is mounted immediately above the frame.



Independent front suspension system of new Daimler 15.

Front independent suspension calls for a chassis frame that is very rigid at the forward end, as the frame front cross member has to take care of much of the load that ordinarily comes on the axle center. The Daimler front end is cross-braced by a deep U-section member that provides the required stiffness at this point. It is also strongly X-braced at the center, and the forward and rear legs of the X member are continued to extend the whole length of the side channels to form box sections.—*The Motor*, August 17.

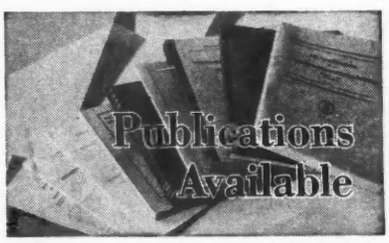
Books of automotive interest

Die Entwicklung des Kraftfahrzeugs, by W. Kamm, V.D.I. Published by VDI Verlag, Berlin NW 7, Germany.

This booklet, which forms one of a series of essays and reports prepared for the German Museum of Munich, deals chiefly with the development of the high-speed gasoline engine and the gasoline-propelled motorcar by Daimler and Benz. It contains illustrations of the first Daimler high-speed engine (1883), the Benz motor-propelled tricycle (1885), the Daimler motor bicycle (1885), the Daimler automobile (1886) and the Daimler railroad inspection car and motor boat. It also contains a review of the present state of development of the motorcar and an outline of the problems which today confront the German automobile engineer in connection with the Four-Year Plan, one of the objects of which is greatly increased motorization of the German nation.

Boat Races Proposed

An annual series of power boat races, two to be held in this country and two abroad, has been proposed by Count Theo Rossi of Italy. The Count has been here for several weeks for racing in the Gold Cup and President's Cup races, in both of which he was runner-up. He suggested to officers of the American Power Boat Association that the races be held and that American drivers use hulls and engines of the Gold Cup class, 732 cu. in.



Leeds & Northrup Co. has issued a folder "T," covering the company's complete line of furnaces for heat treating tools, dies and production parts.*

Caterpillar Tractor Co., Peoria, Ill., has published a 15-page illustrated booklet entitled "Winter Warfare" on snow removal methods.*

Shakeproof Lock Washer Co., Chicago, has begun publication of a new magazine, the *Shakeproof Engineer*. The first issue contains a description of a new product, a thread-cutting screw.*

Product summaries have been published giving the properties of the Roxalin Flexible Lacquer Co., Inc.'s new "Blue Knight Roxyn C" and "Cadmium Water Dip Lacquer No. 3850."*

A booklet describing three new models of

"Chronologs," production control instruments, has just been issued by the National Acme Co., Cleveland. The booklet includes use data. It also describes a new line of switches and solenoids.*

The American Iron and Steel Institute has published section 1 of a steel products manual on pig iron and ferroalloys.

Linde Air Products Co., division of Union Carbide and Carbon Corp., has published a folder entitled "Steel Hard-Facing Procedure."*

A catalog of products has been issued by the Faultless Caster Corp., Evansville, Ind. It is designated as OD.*

Tuthill Pump Co., Chicago, has published a general catalog on pumps. It contains tables and data for applications.*

National Broach & Machine Co. has issued a bulletin on the "Red Ring Gear Lapping Machine."*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

State Road Funds Up 4 P.C.

During the past five years the total income received by state highway departments has been increased but 4 per cent, according to W. C. Markham, executive secretary of the American Association of State Highway Officials, at the annual convention in Boston, Sept. 27. "And yet during that time the state legislatures have increased the state road systems 21 per cent and the departments have gone the legislatures one better by increasing the surfaced mileage 28 per cent," continued Mr. Markham.

"Every state highway department has operated within its budgeted allowances.

"During the past calendar year the state system mileage was increased almost 15,500 miles. This increase is principally in 14 states. The total state system mileage on Jan. 1 of this year was almost 445,000 miles, which is 14.6 per cent of the total road mileage of the country."

AUTOMOTIVE INDUSTRIES

Looks Ahead

AUTOMOBILE SHOWS will still be running in many parts of the country when we begin, in conjunction with Facts, Inc., a consumer survey designed to sample the views of the man in the street on the "car of the future." We'll begin by asking his opinion of 1938 designs, not for the purpose of invidious comparison, but to smoke out how his feeling about the new cars ties up with his opinions on untried designs.

THE TECHNIQUE of the survey has been set up and preliminary plans completed. We're waiting only for enough people to get a look at the 1938 cars to make the survey possible. Anticipated results: a series of four articles by Thomas G. MacGowan, president of Facts, Inc., which will be of fundamental significance to the whole passenger car industry. Publication about Dec. 1.

Gasoline Tax Bill Soars

Motorists of the United States will pay nearly $1,000,000,000 in gasoline taxes this year to the state and Federal governments, or four times what they paid 10 years ago and approximately $100,000,000 more than they paid in 1936, Baird H. Markham, director of the American Petroleum Industries Committee, predicted at an interstate conference on gasoline taxation held in New York City. Delegates representing state organizations of petroleum refiners, distributors and service station operators in the District of Columbia, Delaware, Maryland, New Jersey, North Carolina, Ohio, Pennsylvania, Virginia, and West Virginia attended the conference.

"The first gasoline tax in this country was levied only 18 years ago by the state of Oregon, and approximately one million dollars was collected the first year that the levy was in effect. By 1936 the gasoline tax bill had increased to $872,954,000, a gain of $440,000,000 over 1929.

"For the first six months of 1937 gasoline consumption increased 11.4 per cent over 1936, chiefly because of expanding automobile ownership and greater annual use of motor vehicles among families with low or modest incomes," continued Mr. Markham, who pointed out that most automobile owners in the United States earn less than $30 a week. "If the gain in gasoline use continues at the same rate for the balance of the year, as seems probable, gasoline tax collections for the year will show a gain of $100,000,000 over last year, and the gasoline tax bill of the motorists for the year will stand at about $975,000,000."

NSPA Indexes Rise

The NSPA automotive sales index for August rose to 149 against 131 in July and 140 in August, 1936. The index of replacement parts shipped to wholesalers went to 131 from 120 in July but was below the 138 of a year earlier. Shop equipment and tools shipped to wholesalers went up to 161 against 145 in June and 146 in July, 1936. Original equipment shipped to manufacturers jumped to 215 from 204 in July, against 142 a year earlier. Export shipments were 129 against 123 in July and 94 a year earlier. The figures are computed against average monthly sales for 1934 as 100.

Calendar of Coming Events

DOMESTIC SHOWS

New York, National Automobile Show, Oct. 27-Nov. 3
Toledo, O., Automobile Show, Oct. 27-Nov. 3
Boston, Mass., Automobile Show, Oct. 30-Nov. 6
Washington, D. C., Automobile Show, Oct. 30-Nov. 6
Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
San Francisco, Automobile Show, Oct. 30-Nov. 6
Cincinnati Automobile Show, Oct. 31-Nov. 6
Altoona, Pa., Automobile Show, Nov. 2-6
Akron Automobile Show, Nov. 6-12
Brooklyn Automobile Show, Nov. 6-13
Chicago Automobile Show, Nov. 6-13
Columbus Automobile Show, Nov. 6-12
Omaha Automobile Show, Nov. 6-11
Detroit Automobile Show, Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J., Nov. 6-12
Newark, N. J., Truck Show, Nov. 6-12
Buffalo, N. Y., Automobile Show, Nov. 6-13
Indianapolis, Automobile Show, Nov. 6-13
Newark N. J., Automobile Show, Nov. 6-13
Philadelphia Automobile Show, Nov. 6-13
Pittsburgh, Pa., Automobile Show, Nov. 6-13
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Rochester, Automobile Show, Nov. 13-20
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show, Nov. 14-21
Portland, Ore., Automobile Show, Nov. 14-21
Denver, Colo., Automobile Show, Nov. 15-20

SHOW BUSINESS

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Jersey City, N. J., Automobile Show, Nov. 15-20
Milwaukee, Wis., Automobile Show, Nov. 17-24
Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4
A.S.I. Show, Navy Pier, Chicago, Dec. 6-Dec. 11

FOREIGN SHOWS

France, 31st International Automobile Salon, Paris, Oct. 7-17
Great Britain, 31st International Automobile Exposition, London, Oct. 14-23
Czechoslovakian Automobile Show, Prague, Oct. 16-24
Italy, 10th International Automobile Salon, Milan, Oct. 28-Nov. 8
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London, Nov. 4-13
Toronto, Ont., Automobile Show, Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow, Nov. 12-20
Montreal, Que., Automobile Show, Nov. 20-27

CONVENTIONS AND MEETINGS

National Lubricating Grease Institute, Annual, Chicago, Oct. 4-5
SAE National Aircraft Production Meeting, Los Angeles, Calif., Oct. 7-9
American Foundrymen's Association, Regional Conference, Rollo, Mo. Oct. 8-9
National Battery Manufacturers Asso., Chicago, Oct. 10-12
National Safety Congress & Exposition, Kansas City, Oct. 11-15
National Metal Congress, Atlantic City, Oct. 18-22
National Machine Tool Builders Asso., Annual Meeting, Hot Springs, Va., Oct. 25-27
SAE Annual Dinner, Commodore Hotel, New York, Oct. 28
American Foundrymen's Association, 2nd annual foundry conference, Iowa City, Oct. 29-30
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago, Nov. 8-12
American Society of Mechanical Engineers, New York, Dec. 6-10
SAE National Production Meeting, Flint, Mich., Dec. 8-10
SAE Annual Meeting, Detroit, Jan. 10-14, 1938
American Road Builders' Association, Cleveland, Jan. 17-21, 1938

Skid test gives Cletracs the works as they come to the final assembly line. In background are two DeVilbiss spray booths used for painting completed machines prior to shipment.

Over Twenty Years

By Joseph Geschelin

ESTABLISHED in 1916, The Cleveland Tractor Co., Cleveland, Ohio, has been identified with farm and industrial tractor development for ever 20 years and lays claim to being one of the world's largest builders of such equipment. The company produces the Cletrac crawler line powered by four and six-cylinder engines of either gasoline or Diesel type.

At the present writing the Cletrac line comprises a wide variety of models ranging in rating from 22 to 94 hp. at the draw bar. The latest model—Model E—is an up-to-date streamlined general purpose crawler track machine designed for plowing, discing, harrowing, planting, cultivating, harvesting, etc., with power take-off and other optional attachments. It is available in five different widths and has ample underbody clearance for cultivating operations.

Except for the engine — Hercules gasoline and Diesel heavy-duty power— the Cletrac machines are built completely at the Cleveland plant which houses facilities for machining, gear cutting and finishing, press shop, heat treat and assembly. Production operations include many novelties among which are—the built up and welded track frame structure; continuous crawler track; and the one-piece drop-forged track shoe. The latter is Cletrac designed and patented. The forging is heat treated and differentially quenched so as to produce an extremely hard, wear resistant side rail while the other sections are tough, ductile, and machineable.

As shown in the diagrammatic drawing of the plant, it consists of a

THIS IS THE EIGHTEENTH IN THE SERIES OF MONTHLY PRODUCTION FEATURES

# of Experience

culminates in a plant highly developed in mechanical handling of materials in a unified, straight line flow from department to department of the Cleveland Tractor Co.

number of separate buildings, interconnected by a complete system of materials handling conveyors. Perhaps an unusual feature of the plant, not ordinarily associated with an operation of moderate volume, is the complete mechanization of all materials handling through the medium of the overhead monorails as well as gravity roller conveyor lines connecting machine shop routings. The assembly line conveyor is of modern design and is supplemented by a group of short feeder conveyors on which are built up the various sub-assemblies. The main tractor assembly line is a floor type chain conveyor running some 350 ft. in length. Two of the overhead chains are well worth noting due to their sizable compass. Here is a real heavy-duty overhead monorail that carries track shoes, pins, and bushings, as well as parts from the press shop to the final assembly line. The developed length of the chain is about 2000 ft. Another of the longer overhead chains—about 1600 ft. in length—carries gears, shafts, and other small parts to the assembly line.

To the trained production man, the plant layout presents a unified and modern arrangement with a straight line flow of materials from department to department—all converging eventually to the final assembly line. The final line is flanked by various sub-assembly stations and in addition, is fed component parts and sheet metal by the overhead conveyor.

Materials handling and follow-up are greatly simplified by an ingenious device. In brief, it consists in placing the responsibility for delivery of incoming raw materials and other purchased parts on the vendor who is required to actually deposit his materials directly at the point of usage. As materials are received in the plant, the supplier's truck guided by an employe of the receiving department goes directly to the department for which the shipment is intended and deposits the load there.

Since the Cletrac line consists of a variety of different types and sizes it is only natural to find that work routing is based more on job-lot practice than upon mass production. Consequently there is the grouping of similar machines in specialized departments such as gear cutting, grinding, etc., and the consequent routing of similar parts of different size over the same machines—in general. One large department is devoted exclusively to the production of large cases of various kinds. For this type of work, it has been found desirable to make a more straight-line routing of operations and equipment, and here we find a number of complete lines of machinery for handling similar cases of different size.

In the case department, as will be noted from the routings, are concentrated most of the large milling machines used in this plant, and in gen-

The patented track shoe is a one-piece forging made in four separate operations. Here is a view of the first operation—blanking—on an Erie steam hammer.

eral Haynes J-Metal milling cutters are used wherever possible.

Another important variation from usual practice which has been found most economical here, is to consider heat treatment as an integral part of the machine shop routing. Hence, we find heat-treating equipment distributed in various departments rather than concentrated at one central area. A large bank of carburizing and quenching equipment is found in the areas serving the gear and shaft department and the shoe assembly. Another group of heat-treating equipment is located in the track wheel department. This makes it possible to start with the raw materials and completely process the various parts without leaving a given burden center.

Welding with the electric arc is one of the major assembly techniques in this plant. Fixed booths as well as portable welding equipment are used, the welding equipment being of the current lines supplied by Lincoln Electric, Westinghouse and General Electric. One of the most interesting of the welding operations is the procedure used in building up the track frame, noted on one of the routings reproduced here.

Finally, unusual precautions are taken to prevent the surface corrosion of all manner of parts in process and

Factory Routing Intermediate and Reverse Driving Gear

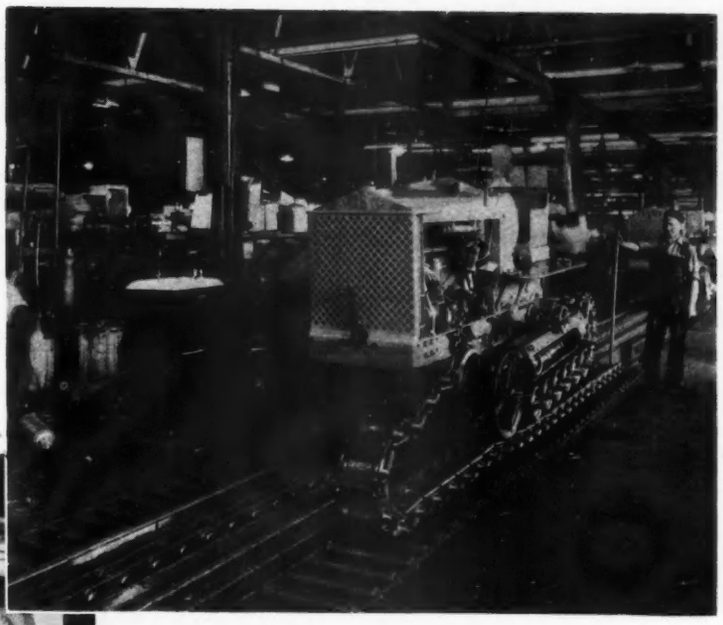
OPERATION	EQUIPMENT
Purchased normalized and free of scale	
Inspect as purchased	
Rough turn gear outside diameter — rough face one side of gear. Form 2¾ in. shoulder—rough face end —drill hole and counterbore	Warner & Swasey No. 2A
Rough face other side of gear —rough turn 3⅝ in. shoulder and face end — rough turn shifter slot—bore and counterbore 1.720-1.722 in. diameter	Warner & Swasey No. 2A
Broach spline	No. 3 Oilgear broach
Finish straddle face gear sides and hub ends—Finish turn outside diameter and form 3/32 in. radii on gear corners—finish turn shifter slot	No. 12 LeBlond multicut lathe
Rough cut teeth	Lees-Bradner hobber
Chamfer teeth round — both sides	W. C. Lipe tooth rounder
Finish cut teeth	No. 7A Fellows shaper
Burr complete	Bench
Carburize	Furnace
Harden and draw	Furnace
Inspect	

Electric arc welding is one of the major activities in the plant, using Lincoln Electric, Westinghouse, and G.E. portable equipment.

Very large bore—very short stroke characterizes this Hutto honing operation on lower track wheel. The honing machine also is a product of Hutto.

in the finally assembled condition. For this purpose, practically every machine line in the plant is provided with its own dip tank equipment in which the parts are immersed for protection.

After the final assembly, as the tractors come off the line, each machine goes through its paces for final running inspection on the skid test which is illustrated in the pictorial section of this article.



(Right) Sub-assembly station on final line showing method used to install track.

(Left) Big Fellows gear shapers are used for rough-cutting transmission gear teeth

For a better appreciation and perspective of the Cletrac production, we have developed a comprehensive pictorial section synthesized in views taken at various points of interest in every department. In addition, we have reproduced a few of the formal routings selected so as to show representative examples of practice. A few of the outstanding high-spots of practice and departmental activity are given more in detail below.

Perspective of final assembly line showing the '38 Cletracs in various stages of completion.

Factory Executive Personnel

R. K. Mitchell	Works Manager
H. C. Kramer	Assistant to Works Manager
C. M. Wallin	Director of Planning
E. R. Fulwider	Superintendent of Machining & Assembling
C. A. Parker	Chief Inspector
Fred Gruber	Superintendent of Press Plant
G. T. Williams	Meta'lurg'st
A. F. Fussner	Master Mechanic
G. L. LaBarr	Supervisor of Methods and Standards
E. A. Teller	Factory Auditor

Gear Cutting

The gear-cutting department is completely equipped for handling the variety of gears—large and small—required in the production of tractor transmissions and drive elements. In addition to the various metal-cutting machines, it is provided with familiar gear-cutting machines such as—Fellows gear shapers, Gould & Eberhardt hobbers, broaching machines, etc. As examples of the techniques employed here, we have reproduced the routing of a number of representative gears and shafts.

Serving as a watch dog on quality in gear manufacture is a completely fitted master inspection department with facilities for checking set-ups, hobs and cutters, and product sampling inspection.

An important function of the master inspection laboratory is that of sampling inspection of complete units to assure conformity of all parts to the

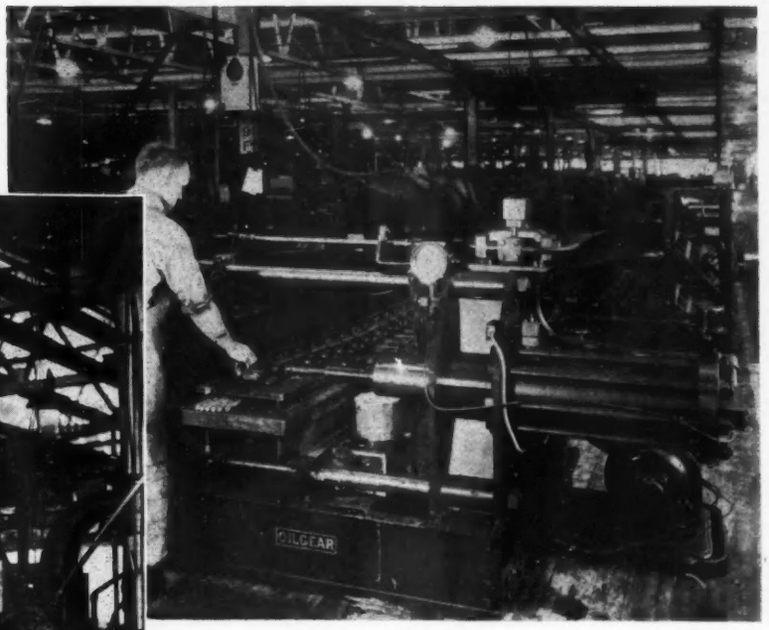
Battery of huge Ingersoll mills head the various machine lines on the big cases.

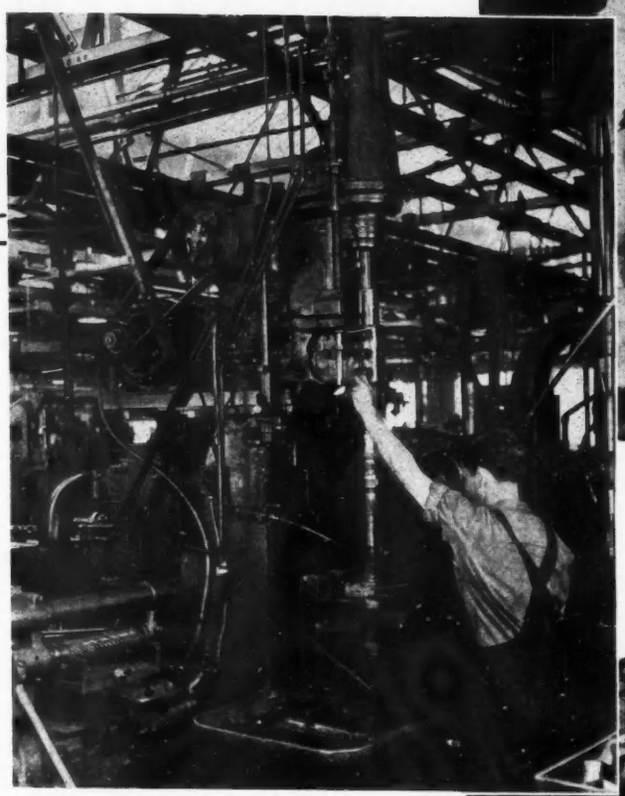
Factory Routing Upper Track Wheel Shaft

OPERATION	EQUIPMENT
Inspect rough forging	
Mill ends to length	No. 1A Davis and Thompson miller—double end
Center one end—drill hole for ⅝ in. 18 thread; tap other end and countersink ¾ in. diameter x 60 deg.	Sundstrand centering lathe
Drill hole in center of shaft	Leland-Gifford deep hole drill
Turn 1.494-1.492 in. diameter, 1.3125-1.3105 in. diameter and 1.185-1.182 in. diameter leaving 0.020-0.025 in. grind stock—Finish turn thread diameter and chamfer—one end—rough turn outside diameter and sides of flange—neck	4 in. semi-automatic Lo Swing lathe
Finish turn outside diameter and sides of flange—turn 3 diameters, leaving 0.020-0.025 in. grind stock—finish turn thread diameter neck and chamfer complete—other end	4 in. semi-automatic Lo Swing lathe
Undercut flange and break corners.	LeBlond short cut lathe
Mill flats each end	Plain Kearney-Trecker mill
Tap ⅝ in.—18 thread hole one end	Rickert Shafer tapper
Drill 3/16 in. hole through flange	Single sensitive drill
Drill "D" hole ¼ in. deep	Single sensitive drill
Cut 1 in.—14 thread each end	Two spindle Landis threading machines
Dope threads for carburizing	Bench
Carburize	Furnace
Harden and draw	Furnace
Clean centers and straighten	Sensitive drill & Rockford press
Grind sides of flange	Cincinnati grinder
Rough grind 1.492-1.494 in. diameter each end	Norton grinder
Rough grind 1.3125-1.3105 in. diameter each end	Norton grinder
Finish grind 1.492-1.493 in. diameter each end	Norton grinder
Finish grind 1.3125-1.3105 in. diameter each end	Norton grinder
Grind 1.185-1.182 in. diameter each end	Norton grinder
Inspect	

Ever present, all-purpose, Bullard vertical turret lathe shown at work on outer cover machining operations.

(Right) Special Oil Gear hydraulic assembly machine used for making up crawler track assemblies.





(Left) Small bore—very long stroke is feature of this Barnes honing machine fitted with Micromatic hone.

(Right) One of the rows of big Natco multiple spindle drills shown at work on transmission cases.

established standards. The procedure is to take certain assemblies right off the production lines, move them into the inspection department, and then tear them down completely for minute inspection of individual parts as well as the functioning of the assembled unit.

Miscellaneous Units

Among the more interesting of the small assemblies is that of the track wheel and hub assembly in which two drop-forged and processed wheels are shrunk onto the hub. Individual wheels are completely bored, reamed, and chamfered in one setting on a battery of heavy-duty No. 6A Potter & Johnston turret lathes. This operation leaves 0.002 in. of stock for a honing operation using an interesting Hutto hone mounted in a Hutto honing machine. The unusual thing about the lapping operations is the fact that the hone is of large diameter as compared with the depth of the cylindrical surface. The diameter is held within 5.376-5.373 in.

In view of the peculiar bore and stroke relation—5⅜in. bore x 1⅝ in. stroke—it has been necessary to design special honing tools comprising short stones, single cone, and single ball design, all of which are variations from the conventional Hutto practice. Abrasives are slightly pivotal about their center lines, producing the equivalent of a secondary universal motion midway of the stone length. A mat finish is specified.

After machining, the wheels are heated to 1500 deg. Fahr. in a Hevi-Duty electric furnace installed in a pit in the floor. As the wheels are taken out of the furnace, they are slipped onto the ends of the cast iron hub and

upon quenching for hardening produce a permanent shrink fit.

Another noteworthy honing operation in the same department is that of honing bearing boxes in which the dimensional characteristics are quite the reverse of what has been described above, i.e., with very long stroke and comparatively small bore. This is done on a Barnes honing machine fitted with Micromatic hones.

The lower track wheel bearings are nominally 2½ in. in diameter and 11 in. in length. They consist of two longitudinal halves which are bored separately, then fitted with dowel pins and bolted together, drilled, reamed, and both ends turned. Following this, the long hole is honed to specifications requiring from 75 to 80 per cent bearing area. Production is approximately 25

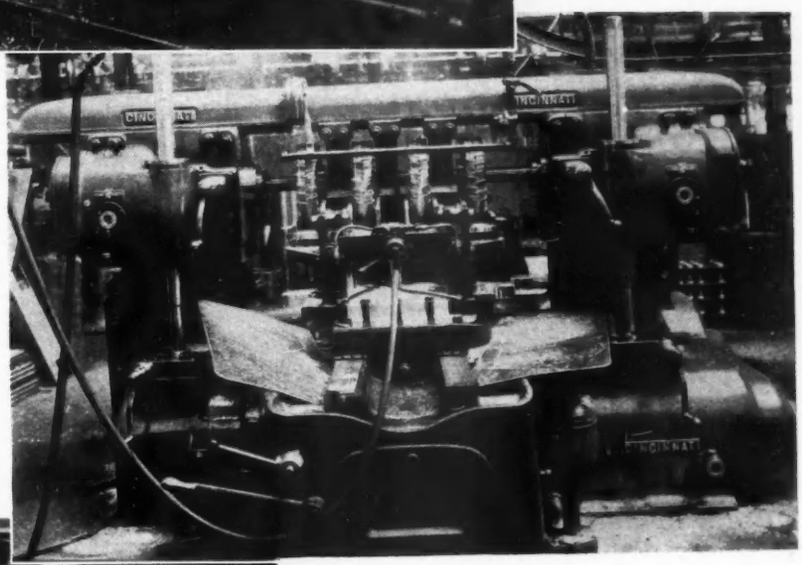
Factory Routing Transmission Case

(Stud and Assembly Bearing Cap)

OPERATION	EQUIPMENT
Inspect casting	
Paint, dip and move to storage	Tank
Mill top face both sides for inner covers and sides of six bosses—3 each side	Ingersoll miller
Mill front face	Milwaukee miller
Mill power take off face and back pads	5-48 Cincinnati Hydromatic miller
Mill bottom pads	Brown and Sharpe No. 13B miller
Rough and finish bore 17,000-17-005 in. diameter	Rockford horizontal boring machine
Drill, spotface and tap differential bearing bosses	3 ft. radial drill
Assemble (1) differential bearing cap—right hand	
(1) Differential bearing cap—left hand	
(4) Studs	
(4) Nuts and necessary shims	
Differential cross bore — rough and finish bore 5.1179-5.1189 in. both sides and cut two 0.187-0.189 in. ring grooves on one side	Rockford upright and horizontal boring machine
Front end—walls A and B rough and finish bore	
Middle holes—walls A and B —rough and finish bore and seat	
Bottom holes—Walls A and B rough and finish bore	
Hand ream 2.749-2.751 in. and seat 3.149-3.1502 in bores 3.9368-3.9376 in. and seat 3.9368-3.0376 in. bores, 1.99-2.005-1.749-1.7505 in. bore, 4.7242-4.7252 in. bore and 5.1179-5.1189 in. differential bearing bosses.	
Right half side—drill 32 holes —drill and ream one 1.126-1.128 in. hole	Natco multiple drill
Left half side—drill 31 holes and drill and ream 1—1.126-1.128 in. hole	Natco multiple drill
Top side—drill 43 holes—lay-out one hole for drilling one ¾ in. pipe plug hole	Natco multiple drill
Front end—drill ten 21/32 in. holes and two holes for ⅝ in.—11 thread, tap	Natco multiple drill
Front end and walls—A and B—tap two ⅝ in.—11 thread holes—drill and ream 2—1.001-1.003 in holes through	American 4 ft. radial drill
A and B walls, drill and countersink two 13/16 in. holes through ream bosses and tap two one ⅝ in. x 10 thread holes in shifter shaft bosses, drill and tap ten ½ in. x 13 thread holes	
Rear end—drill and tap nine ½ in. x 13 thread holes, line drill eight 13/16 in. holes and countersink 8 holes—spotface two bosses and drill and countersink two 13/16 in. holes in rear bosses, rough and finish bore 6.502-6.498 in. diameter	American 4 ft. radial drill
Right half side—Tap (20) ¾ in. thread holes—tap one 1 in. pipe tap hole—tap and spotface two ½ in. holes, tap and spotface one ¾ in. hole—ream four 0.745-0.746 in. holes, ream one 0.557-0.558 in. hole, drill and ream one 1.126-1.128 in. hole, drill and ream one 1.001-1.003 in hole through inner bosses and tap one ¾ in pipe tap in out wall, drill and ream 0.877-0.879 in. holes brake shackle shafts, drill and spotface 2 13/16 in. holes and drill two 1½ in. holes.	American 4 ft. radial drill
Left half side—Tap (20) ¾ in.—10 thread holes, tap and spotface two ½ in. holes, tap and spotface one ¾ in. hole, ream four 0.745-0.746 in. holes, ream one 0.557-0.558 in. hole, drill and ream 2 holes, tap one ¾ in. pipe tap hole in out wall. Spotface and counterbore one 13/16 in. hole and drill two 1½ in. holes	American 3 ft. 9 ft. column Radial drill
Top Side—Tap 40 holes, drill and tap 4 holes, tap 2 holes, and drill one hole and spotface top side. Drill and tap 1 hole, drill and ream 2 holes	American 3 ft. 9 ft. column radial drill
Bottom side—Drill and tap 12 holes, spotface 1 hole to length, drill and tap 4 holes	American 3 ft. radial drill
Wash and blow out with air, line ream two shift shaft holes	Blakeslee washer

(Top) Sundstrand centering lathe at work on upper track wheel shaft.

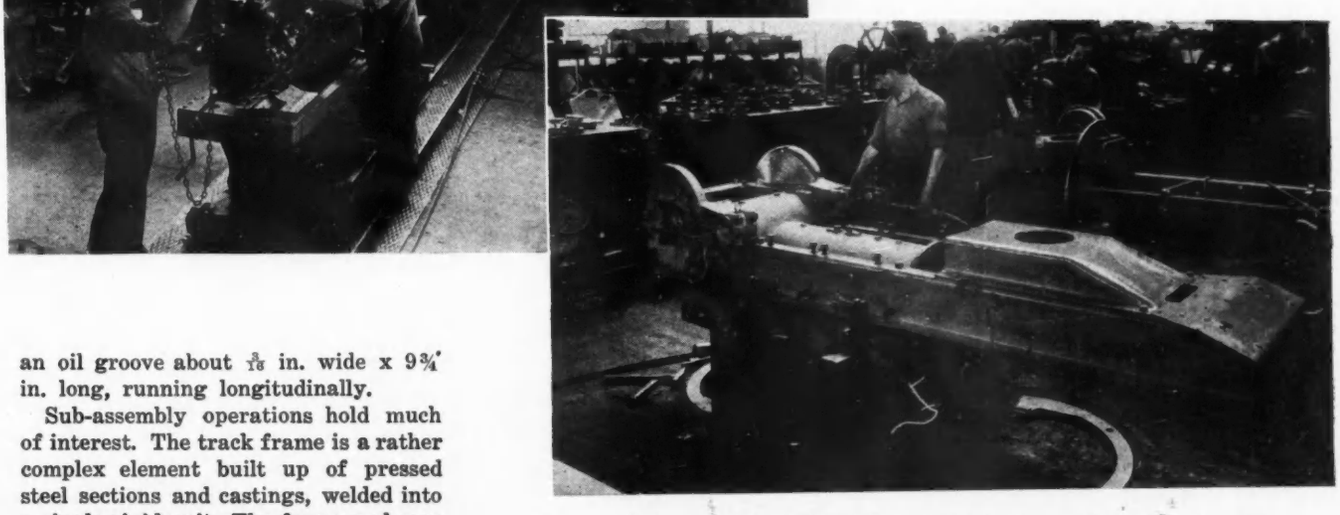
(Below) Huge Cincinnati milling machine with four double-faced milling cutters is set up for machining Model E track frame housing.



to 30 bores per hour, removing 0.0025 in. of stock, using 280 grit stones. The honed bore is held within 0.0004-0.0005 in. for straightness and out-of-roundness.

One of the complications that has to be overcome in this honing operation is the fact that there are two sets of interrupted cuts—a machined groove about ¾ in. wide located centrally, and an oil groove about $\frac{3}{16}$ in. wide x 9¾" in. long, running longitudinally.

(Left) Engines are prepared on a line at the side and then installed in the frame at the initial stages on the final assembly line.



Sub-assembly station for track and transmission case assembly. Note the large trunnion type assembly fixtures.

Sub-assembly operations hold much of interest. The track frame is a rather complex element built up of pressed steel sections and castings, welded into a single rigid unit. The frame and case assembly is built up on roll-over fix-

Factory Routing Transmission Reverse Gear

OPERATION	EQUIPMENT
Purchase normalized and free of scale	
Inspect forging	
Finish turn 5.495-5.500 diameter—finish face end. Turn half of neck diameter. Face inside of large gear diameter. Form 3/32 in. radius on large gear dia. Drill hole and countersink 1/32 in. x 45 deg.	No. 2L Gisholt lathe
Finish turn 4.245-4.250 in. diameter. Finish face end—Turn neck diameter rest of way—face inside of small gear diameter—Bore and ream 2.125-2.126 in. diameter leaving grind stock and chamfer 1/32 in. x 45 deg.	No. 2L Gisholt lathe
Finish face undercut on large gear face	Monarch engine lathe
Rough cut teeth—large gear two per setting)	Lees-Bradner hobber
Rough cut teeth—small gear	Fellows shaper No. 624
Chamfer teeth round—one side of large gear	Consolidated tooth rounder
Finish cut teeth—large gear	Fellows No. 7A gear shaper
Finish cut teeth—small gear	Fellows No. 7A gear shaper
Burr complete	Bench
Carburize	Furnace
Harden and draw	Furnace
Grind 2.125-2.126 diameter	Heald grinder
Grind face of small gear	Norton grinder
Grind face of large gear	Norton grinder
Inspect	

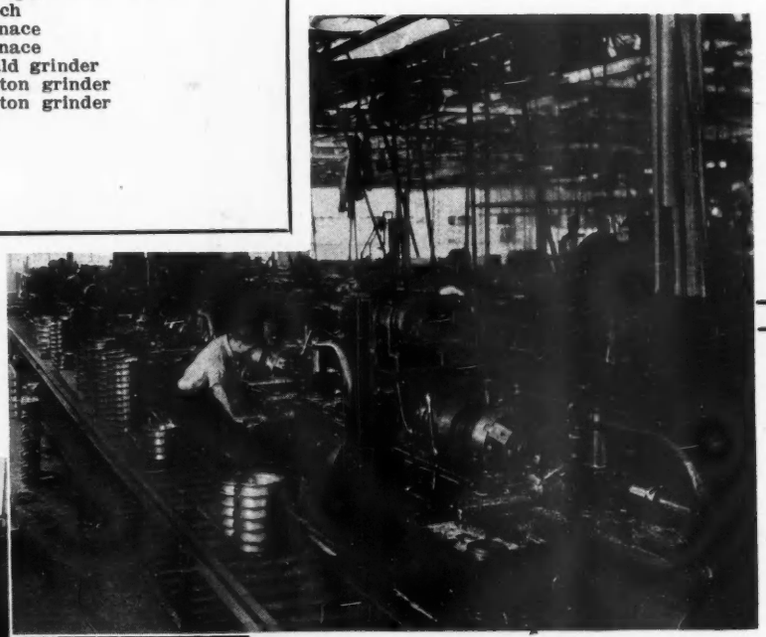
tures due to the weight of the unit and then lifted by a crane for transporting to the assembly line. In the same section will be found a number of unique track assembly machines made by Oilgear in which are produced the continuous crawler track.

The press shop is equipped to handle unusually heavy stamping work as many of the elements are formed from sheet and strip up to ¾ in. in thickness. One of the new items of equipment in this department is the Cincinnati square shear with electric holddown mechanism for shearing stock up to ½ in. thick, to exact size.

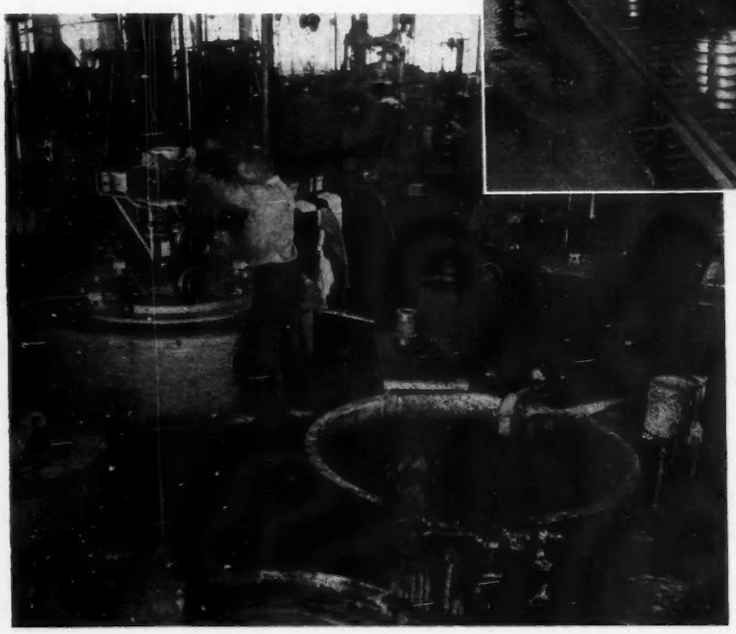
A feature of the press shop is a basement level below the working floor which is used for storing dies. A hoist is used for transporting die equipment to and from this storage space.

Service Building

One of the outermost buildings, as shown on the layout of the plant, is used as a special service department. It has a number of important functions. In the first place, it is used for service stores and for the manufacture of obsolete and discontinued parts. As a part becomes obsolete for any reason, special equipment required for its pro-



(Above) View of battery of Potter & Johnston heavy-duty turret lathes, boring and reaming lower track wheel.



(Below) Hevi-Duty electric furnaces installed right on the machine line. This view shows equipment for assembly of track wheel and hub, as described.

duction is moved into the service building and set up ready for production as required.

A corner of this department is set aside for the assembly of the very large tractors—Model 80—on which production is relatively small. Another section is used for building special specification machines. In practice, no special options are handled on the main assembly line. Where special work is required, the machine is built first to standard specifications and then turned over to the specialty department where it is torn down so far as necessary and fitted with the special attachments. This has been found to be the most economical way of handling special equipment in an activity where specials are exceptions to the general rule.

In addition to the foregoing, the service building also is used for experimental work in the development of new units or new tractors or in the investigation of improved construction. The general character of the work in this department lends itself peculiarly well to the handling of their experimental work.

Two-spindle Landis threading machine threading ends of upper track wheel shaft.

W. C. Lipe tooth-chamfering machine used on intermediate and reverse driving gear.

Heat Treatment

As mentioned earlier, the heat-treating department is decentralized so as to provide equipment and process at points of direct usage—and is considered as a part of the machining operations in this plant. The transmission gear department is equipped

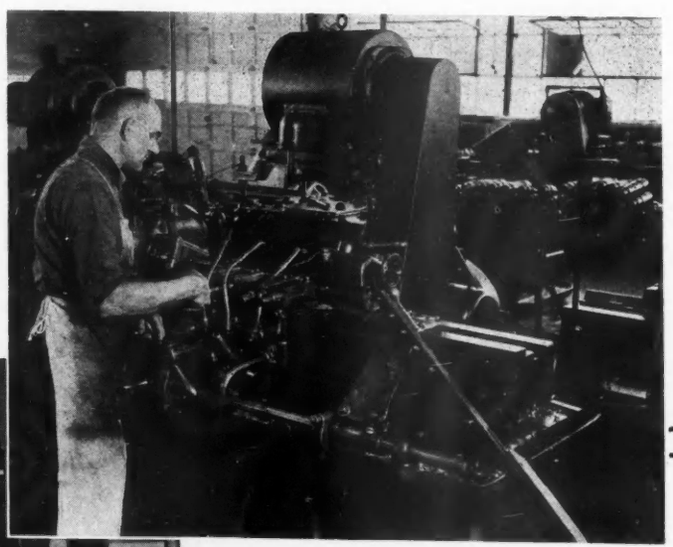
Lees-Bradner hobber rough-cutting transmission reverse gear.

Factory Routing Transmission Drive Shaft

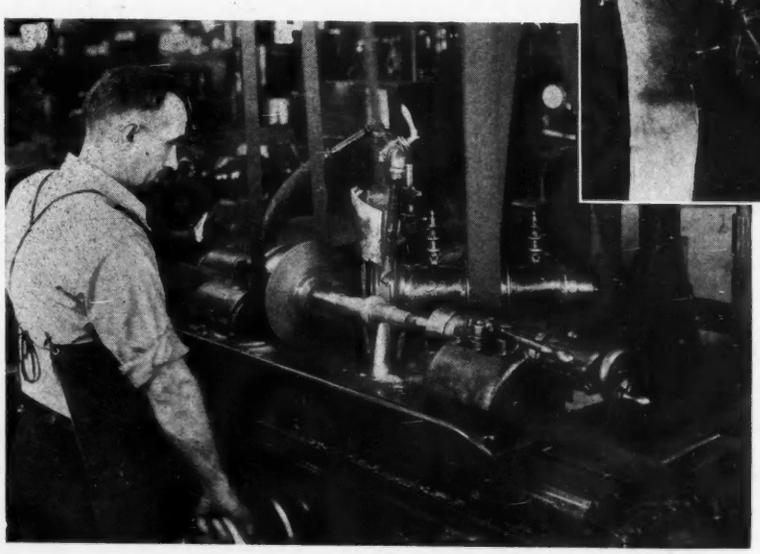
OPERATION	EQUIPMENT
Purchased annealed bar stock cut to length	
Inspect as purchased	
Center both ends	Cadillac centering lathe
Turn 2.108-2.110 spline diameter part way. Turn 1.7715-1.7719 in. diameter. Turn 1.739-1.741 in. diameter leaving grind allowance on all. Rough turn thread diameter and undercut	4 in. Lo Swing lathe
Turn 2.108-2.110 in. spline diameter rest of way. Turn 1.7715-1.7719 in. diameter. 1.739-1.741 in. diameter leaving grind allowance on all. Rough turn thread diameter and undercut	4 in. Lo Swing lathe
Finish turn thread diameters each end. Undercut and chamfer complete	4 in. Lo Swing lathe
Cut long spline diameter	No. 1 Lees-Bradner hobber
Cut spline 2 1/16 in. long—one end	No. 1 Lees-Bradner hobber
Cut spline 2¼ in. long—other end	No. 1 Lees-Bradner hobber
Drill two 17/64 in. holes through thread one end	Sensitive drill
Drill two letter "F" holes through thread other end	Sensitive drill
Countersink both sides of all drilled holes 1/32 in. deep	Sensitive drill
Cut 1 in.—8 thread each end	No. 6 Swarner & Swasey
Green grind long spline diameter	Norton grinder
Burr comp'ete	Bench
Carburize	Furnace
Harden and draw	Furnace
Clean centers and straighten	Flexible power press
Finish grind 2.108-2.110 spline d'ameter	Norton grinder
Grind 1.7715-1.7719 in. diameter each end	Norton grinder
Grind 1.739-1.741 in. diameter each end	Norton grinder
Inspect	

with two Surface Combustion Eutectrol carburizing furnaces; Electric Furnace equipment with conveyor hearth; cyanide pots; and draw furnaces.

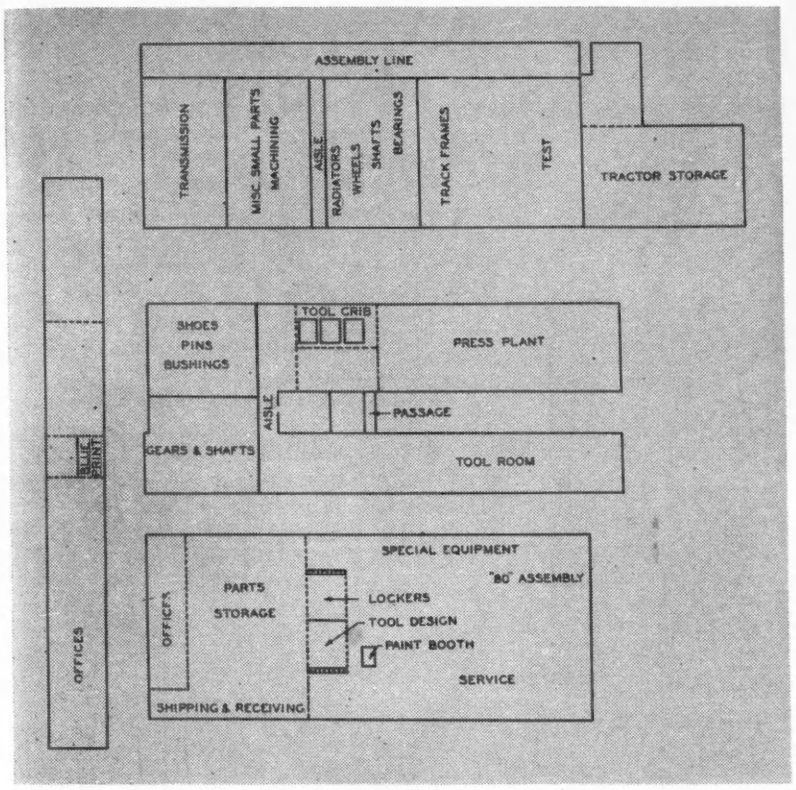
Power shafts are made from SAE 4150 steel and heat treated before machining, constituting a rather severe metal removal operation due to a surface hardness ranging from 350 to 402 Brinell. The general run of gears and shafts are made from SAE 3115 steel



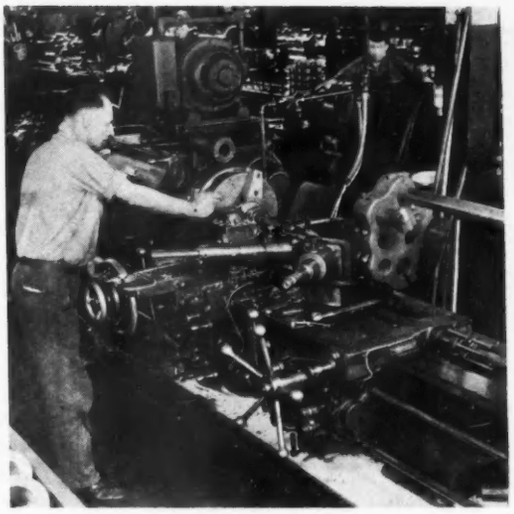
Lo-Swing lathe turning—operation 3—transmission drive shaft.



(Left) Cincinnati grinder finishing flange sides on upper track wheel shaft.



Plant layout of Cleveland Tractor Co. by departments

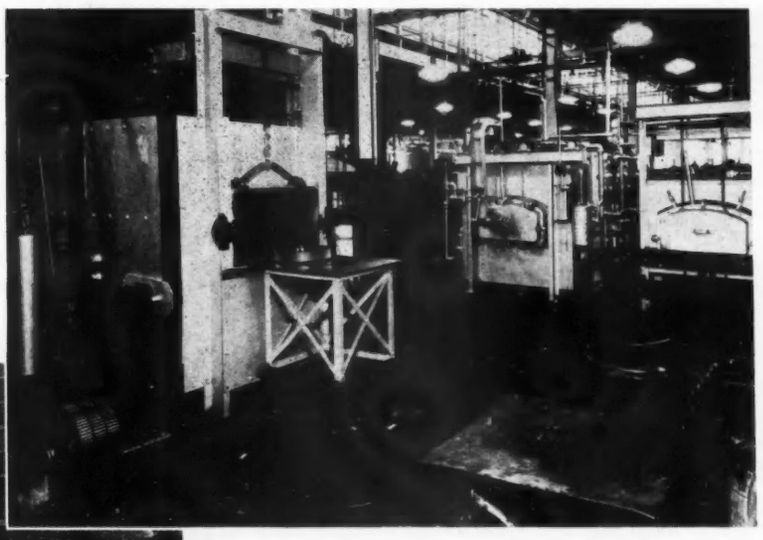


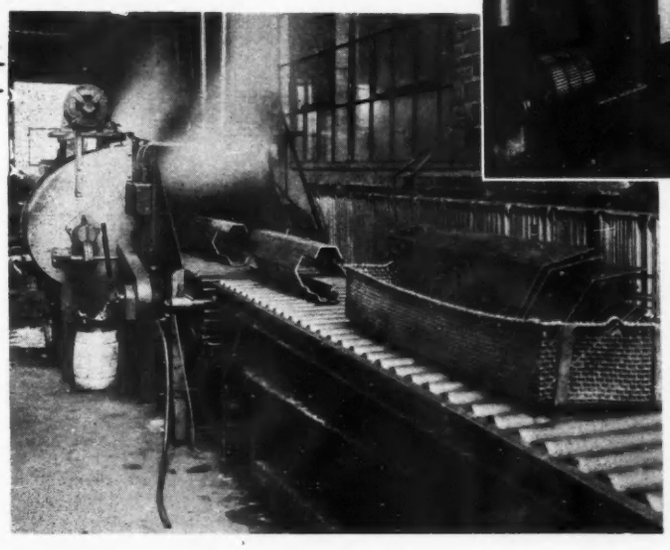
No. 2L Gisholt turret lathe set up for initial turning operations on transmission reverse gear.

heat treatment of pins and bushings and is equipped with a battery of eight Rotary gas carburizing furnaces. These parts are case carburized, then hardened in pusher type electric furnace, then quenched in a caustic soda solution. The case ranges from 0.060 to 0.120 in. in thickness and is held to a hardness of Rc65 minimum.

carburized and hardened after machining. The cycle consists in carburizing followed by direct quench.

The track department handles the





General view of heat treat equipment in transmission department showing—Surface Combustion Eutectrol furnaces; Electric Furnace equipment with conveyor hearth; and cyanide pots and draw furnaces in the vicinity (not visible in this view.)

(Left) Blakeslee washing machine cleans the heavy-gage formed sections for track frames prior to sub-assembly and welding operations.

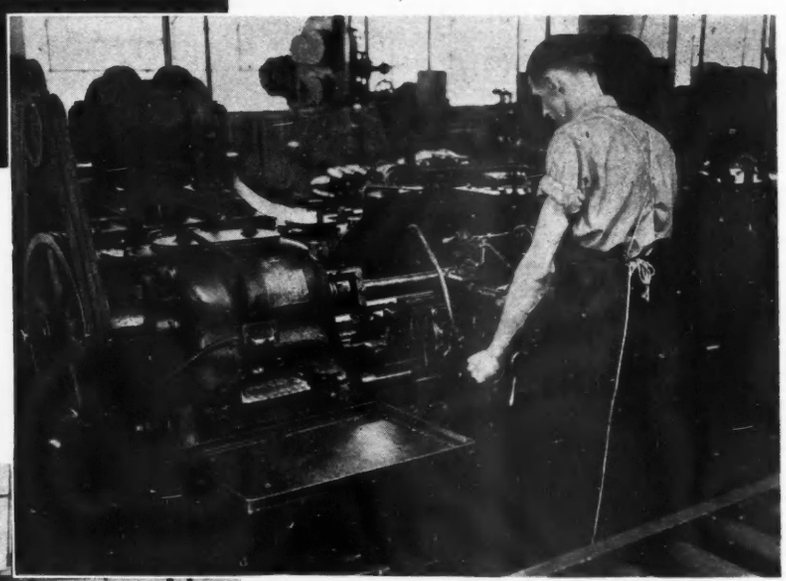
The track wheel shaft, idler, is made from SAE X1020 steel and heat treated. It is carburized in a new Hevi-Duty electric vertical carburizing furnace set in the floor, producing a case ranging from 0.060 to 0.075 in. The work is next hardened in special electric furnaces to a minimum of 65 (Rockwell C), and then drawn.

The wheel and hub assembly mentioned earlier consists of two SAE 1045 wheels shrunk onto a cast iron hub. The wheels are heated in a Hevi-Duty, vertical electric furnace set in the floor, handling two wheels at a time on special hangers, suspended from a rotating spider. As they emerge from the furnace, the wheels are dropped onto the hub and then quenched so as to produce a combination of shrink fit and properly hardened wheel surfaces.

It will be noted from the foregoing that Cletrac uses gas-fired and electric furnaces of various types, all automatically controlled and equipped with recording instruments. In the selection of heat-treating equipment, fuel was not of primary importance, as it may be in other plants. Instead, they consciously chose the kind of operating cycle that would be best fitted for the specific operation. For example, pit type Hevi-Duty furnaces were selected because they took up very little productive space in a crowded department but principally because this particular location in the plant could not tolerate fumes of any kind and, moreover, it was desirable to limit heat radiation so far as possible.

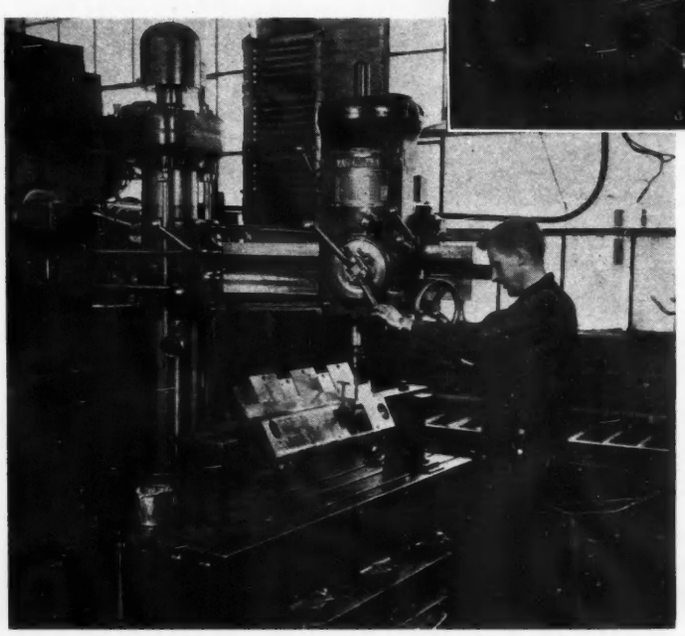
On the other hand, when it came to pins and bushings for the shoe assembly, they selected the horizontal rotary type gas-carburizing furnaces since this type of equipment makes it possible to handle small parts without loading fixtures and yet assures a uniform case.

Turning main drive shaft on Lo-Swing lathe



Brown & Sharpe milling machine boring and reaming front bore and face on track frame housing.

(Below) One of the new American radial drills at work on the track frame housing.



Just Among Ourselves

Selling Better Than Yelling

DO automobile dealers as a group make a respectable return on their invested capital? Are the grievances for which they seek legislative balm in several states well founded? These are questions for which two complete and opposed sets of answers are available, according to where the questions are asked.

The other day at lunch, a factory marketing executive belonging to one of the "big three" was telling his organization's side of the story. Eighty-five per cent of our dealers, he said, average 23 per cent on their net invested capital. The figure seemed incredible to us, but he stuck to it, so we're just passing it along in confident expectation of back talk from dealer sources.

Discussion of dealer grievances against factories brought out another remark which seemed against the main current of factory opinion. The best dealers we have, said the speaker, are those that yell the loudest and are the hardest to hold down.

Another voice added, quietly, "so some of them put as much effort into selling as they do into yelling." It's an interesting thought.

What Has Been and Is to Come?

WHAT will the labor weather be like during the autumn and winter? A plumbing of the present sentiment in the industry does not disclose the expectation of serious explosions, but annoying interruptions to production are awaited with fatalistic resignation.

We regret to chronicle here that 1937's strike may have some souring effect on sales of 1938 cars. Amazing to us has been the discovery of how many prospective car buyers feel that labor troubles may have affected 1938 car design for the worse. We've tried to point out to some of them the essential screwiness of the idea, but the reaction in most of such cases has been: "That's my opinion, and I like it."

How Much Is Its Influence?

THE appearance of a new *Consumers' Research Bulletin* is always an event around the office. In spite of our professional interest in automobiles we usually turn first to the soap section to learn what will be safe to wash and shave with tomorrow morning.

This will introduce the fact that we'd like to know what our factory-connected readers can contribute on the subject of how much influence, good or bad commercially speaking, *Consumers' Research* opinions have had on the sale of their product.

Any replies received will not be published in any way that will reveal the name or connection of the writer. If enough replies are received to be significant, they will be summarized briefly in this place.

Honesty is as Honest as—

PEEWEE, Dick, Charlie, Bootlegger and Joe are horses and mules which age and the trend toward motorization have made "surplus property" for the U. S. Army. In advertising them for sale the Army set some standards for truth in advertising which are seldom approached in the used-car field.

Here are the specifications, as advertised:

Peewee, a mule, approximately 20 years old, tender footed and stiff in the joints.

Dick, a mule, about 18, weak tendon that causes left hind leg to drag.

Charlie, also a mule, about 18, windbroken.

Bootlegger, a horse, 20, "too fast for ordinary farm work."

Joe, a bay horse, 21, tender feet make him lame when used regularly.

Comparable used-car advertising would possibly seem even more startling and we submit, might read something like this:

Family Pride, a jallopy driven 142,867 miles. An automobile dealer offered us $30 for it, as trade-in junk. Maybe its worth a few dollars more to somebody who isn't particular. It stalls in traffic, is jumpy in low gear, and our youngest daughter refuses to drive it because it unsettles her finger wave. Pings loudly on anything but premium gas and gets all of 7.21 miles per gallon. Voracious appetite for oil. Sucker bids gratefully received, but positively will not sell to a nervous person.—H. H.

Four Packard Lines

for 1938 include longer "Six" and "Eight"; cars have redesigned oiling system; improved rubber engine mounting and new rear suspension. Senior lines of "Eights" and "Twelves" refined.

FOUR lines of cars will be offered by Packard for 1938—the Six, Eight (formerly the 120), Super-Eight, and Twelve—with 35 different body models.

The Junior line, consisting of the Six and Eight, incorporates many important changes. First are the new all-steel bodies with seamless steel tops, using eleven different types of thermal and acoustic insulating materials. Next is the increase in wheelbase of 7 in. on both models, making that of the Six, 122 in. and that of the Eight, 127 in. This very marked increase in chassis length has made possible further refinement in the characteristic Packard styling.

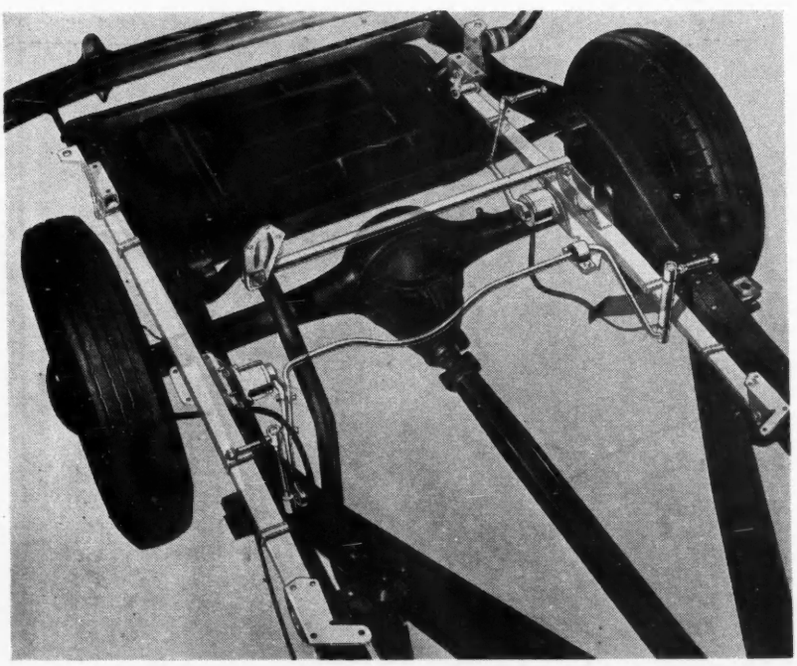
The next important mechanical improvement is the complete isolation of the wheels from the body and frame by the generous use of rubber at various points. Perhaps the most outstanding development on the Junior line is a unique spring suspension using a controlled friction leaf spring in combination with a special hookup of shock absorbers, sway bar and rear stabilizer. This is said to give an unusually good ride with no wander and no reaction at the front.

The principal chassis units remain substantially the same as before, except for detail changes to be mentioned later.

The Senior line models have been improved in many particulars, to be noted later, but remain substantially the the same mechanically and in body construction.

All lines have thermostatically-controlled radiator shutters as standard equipment. All four engines are now fitted with the Bohnalite Autothermic pistons, first used last year on the Six, which, in the case of Senior engines, have Type 200 Perfect Circle compression rings in the top grooves. Slanting V windshields are used throughout with windshield defrosters consisting of long louvers in the garnish molding. Hypoid rear axles and independent front springing (the Safe-T-Flex system) are continued on all lines.

Of particular interest to car owners and service men is the redesigned lubricating system which requires attention only at 5000-mile intervals.



Close-up of rear spring arrangement, Packard Six and Eight, showing stabilizer mounted on spring pad at one end and frame cross member at the other

Junior Line

Engines remain basically the same. The Six is an L-head design of 3½-in. bore by 4½-in. stroke (245 cu. in. displacement), which is 1/16 in. more bore than last year. The rating remains the same, 100 hp. at 3600 r.p.m., but the torque in the lower speed range has been improved. The standard compression ratio is 6.52 to 1 with a cast

iron head, but an option is given on a ratio of 7.05 to 1 with an aluminum head.

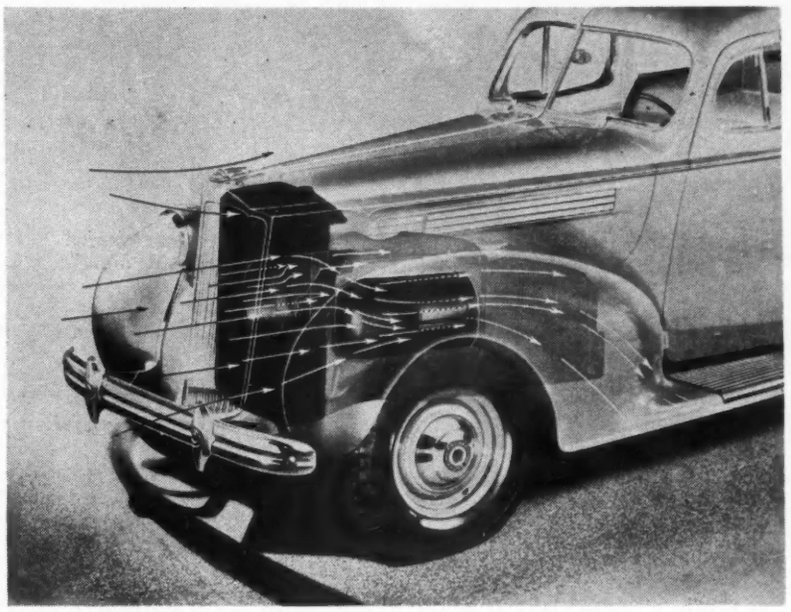
The Eight remains an L-head design of 3¼ in. bore by 4½ in. stroke (282 cu. in. displacement); it is rated 120 hp. at 3800 r.p.m. The compression ratio has been increased to 6.6 to 1 with aluminum alloy head; an optional ratio of 7.05 to 1 is also available.

The following new features are common to both engines: improved rubber engine mountings, a new camshaft, new pressure-lubricated mushroom tappets, longer water jackets, Autothermic tin-plated pistons, a ball-bearing water pump of larger capacity, an 18-in., low-speed fan, thicker main bearing caps, and a generator of larger capacity.

Both engines are equipped with an oil filter of the two-stage type. Ordinarily the oil fed to the tappets goes through the filter in the conventional manner but when the filter becomes blocked, a suitable bypass and an auxiliary screen assure oil supply to the pressure-lubricated tappets. This will protect the engine even if the owner fails to replace the filter element at the right time.

Radiator and front fenders are mounted independently on a cushioned support on the front cross-member. In addition to the usual air vent through the hood louvers, Packards now have cooling tunnels built into the front fender aprons, which take under-hood air and carry it out under the running boards.

The camshaft is driven by a short, wide, toothed chain. Cams are of new quick-opening-and-quick-closing type. Camshafts are Tocco-hardened. Vibration dampers are standard. The vacuum pump for the windshield wipers is built in as a part of the fuel pump,



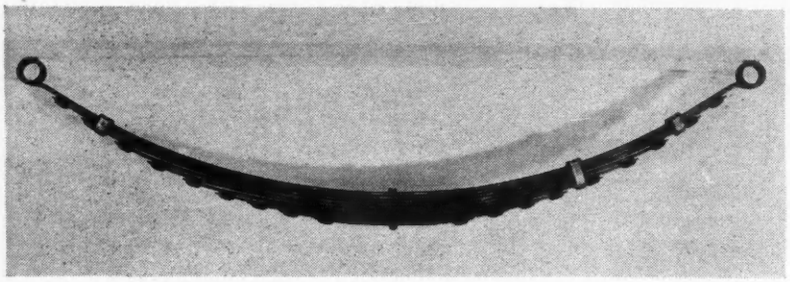
Phantom view showing new under hood ventilating system on Packard Six and Eight. Heated air scooped in through tunnels mounted on fender skirt and vented to running board

Packard Twelve Body Models

Model		Wheelbase
1607	4-door, 5-pass. formal sedan	134
1607	4-door, 5-pass. touring sedan	134
1607	4-door, 5-pass. club sedan	134
1607	2-door, 5-pass. coupe	134
1607	2-door, 2-4-pass. coupe	134
1607	2-door, 2-4-pass. convertible coupe	134
1607	2-door, 5-pass. victoria	134
1608	4-door, 7-pass. touring sedan	139
1608	4-door, 7-pass. touring limousine	139
1608	4-door, 5-pass. convertible sedan	139

Packard Super Eight Body Models

Model		Wheelbase
1603	4-door, 5-pass. touring sedan	127
1604	4-door, 5-pass. formal sedan	134
1604	4-door, 5-pass. touring sedan	134
1604	4-door, 5-pass. club sedan	134
1604	2-door, 5-pass. coupe	134
1604	2-door, 2-4-pass. coupe	134
1604	2-door, 2-4-pass. convertible coupe	134
1604	4-door, 5-pass. victoria	134
1605	4-door, 7-pass. touring sedan limousine	139
1605	4-door, 7-pass. touring sedan	139
1605	4-door, 5-pass., convertible sedan	139



Rear spring for Junior line showing friction control buttons at spring leaf ends. Springs will have unpacked metal covers

to assure a constant wiper speed under all conditions. The water pump has double ball bearings with a new type of packless, self-adjusting seal.

Generator capacity has been stepped up to a cold output of 28.3 amp. at 8 volts on the Six, and 30.5 amp. on the Eight. Both have vibrator-type voltage regulation. Batteries are located under the front seat. The battery on the Six is a 15-plate rated 94 amp. hrs. capacity; that on the Eight is a 17-plate, rated 114 amp. hrs.

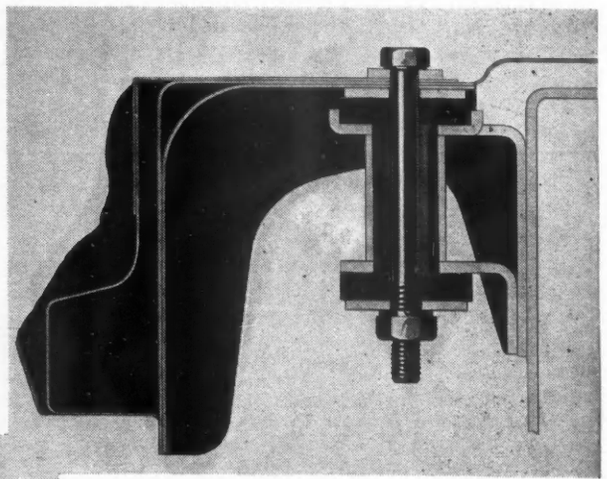
Clutches remain the same (9½ in. on the Six and 10 in. on the Eight) except that they incorporate a new release mechanism which reduces the tendency to harshness or chatter. The only change in the transmissions is that the face width of the second-speed gears has been increased to 1 in.

Packard's double-trussed frame design is continued, with improvements to make up for the decrease in torsional rigidity due to the longer wheelbases. In the new frames, the X-member consists of I-beam rails of tapered section, deepest at the center, welded to reinforce the riveting. From the terminals of the X-member at front and rear, the side rails are of box section.

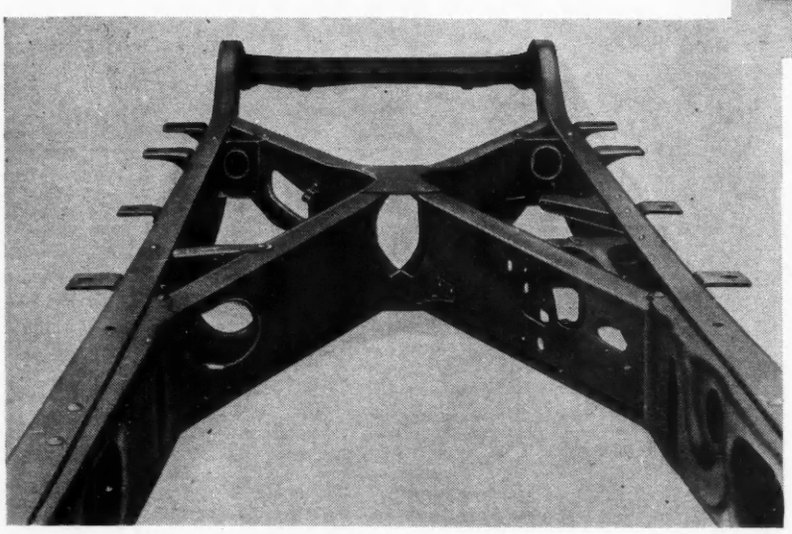
While the front springing is continued unchanged, a rubber cushion has been introduced under each coil spring so as to insulate the entire mechanism from the frame.

Coming to the rear suspension, the leaf springs have controlled-friction characteristics and are provided with unpacked metallic covers. Spring leaves are separated by bedded buttons at the tips, three types of buttons being used—rubber, Oilite bearing material, and a special white metal alloy. Completely rubber-floated shackles are used both front and rear to avoid metal-to-metal contact.

The new rear suspension system also incorporates a lateral stabilizer or radius rod, fixed to the axle at one end and to the frame at the other, which eliminates the tendency to wander or steer at the rear. Then there is the roll-control bar or sway-bar at the rear, ahead of the axle. In addition, Packard has devised a novel shock absorber hook-up which serves as a torque arm. As illustrated, the shock absorber linkage has relatively long arms, on one side the linkage is pointed to the rear, on the other side to the front.



New body mounting with rubber insulated body bolt



Close-up of X-member showing box section at front and rear ends, special bracing, and use of welded joints to reinforce rivets

A very interesting feature of the hypoid rear axle which probably has not received all the attention it deserves, is the use of an unusual spacer between the two pinion-shaft bearings. Its function is to preload the bearings at assembly. As illustrated, the spacer has an extremely thin section near the larger end, and during assembly, as the bearings are being pre-loaded, the thin section begins to buckle so that the amount of pre-loading is substantially independent of the amount of maximum pressure that may be imposed by the nut. Another interesting point is that the pinion shaft end has the Marsden

thread, which cannot loosen under vibration.

Both cars have 48 ball and roller bearings in addition to numerous rubber mountings.

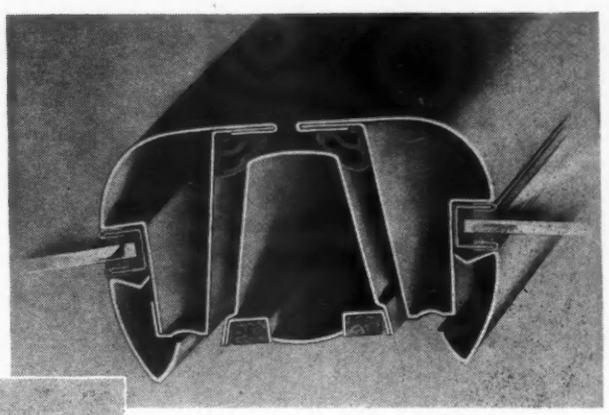
Senior Line

The senior line consists of two basic chassis models—the Super Eight and the Twelve. The Twelve is available in two chassis lengths—134 and 139 in.—and 10 body styles. The Super Eight is available in three wheelbases—127, 134, and 139 in.—and in 11 body styles.

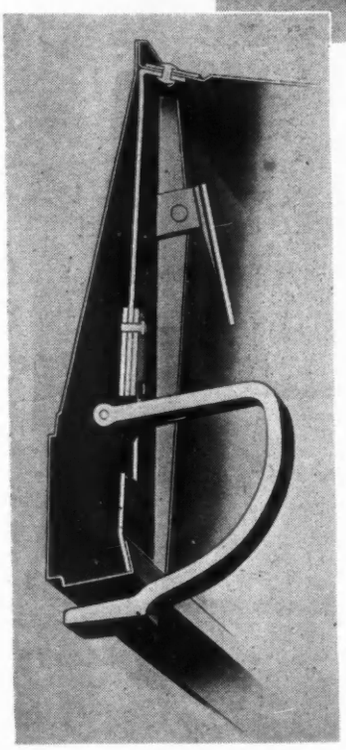
The Twelve engine remains the same, an L-head type with blocks at 67 deg., the cylinders having a 3 7/16-in. bore and a 4½-in. stroke (473 cu. in. displacement); it is rated 175 hp. at 3200 r.p.m. The compression ratio is 6.4 to 1.

The Super Eight also has L-head cylinders of 3 3/16 in. bore by 5 in. stroke (320 cu. in. displacement); it is rated 135 hp. at 3200 r.p.m., with a compression ratio of 6.5 to 1. On the Super Eight, the cylinder block has been improved by the use of longer water jackets and the introduction of a circumferential rib around the upper end of each cylinder barrel. This combination increases the rigidity of the cylinder walls and aids in preventing cylinder distortion, so that the bores remain true and round.

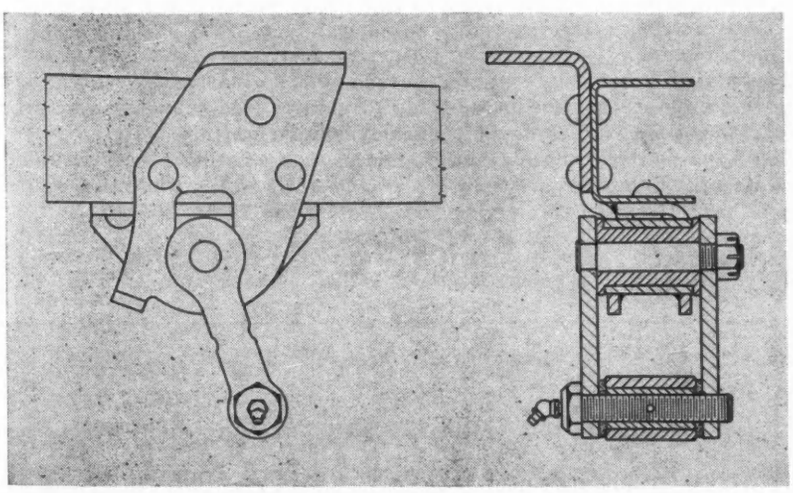
Valve-stem lubrication has been improved by changes in the block and crankcase ventilator. The crankcase outlet now is tapped into the front valve chamber cover, and fumes are carried to the under side by an extension tubing. Larger impeller-shaft bearings increase the life of the Super Eight pump.



(Right) Cross-section through body center pillar



View showing concealed body hinge



Rear spring rear shackle. The bushing of the upper spring bolt is rubber

Bodies and Interiors

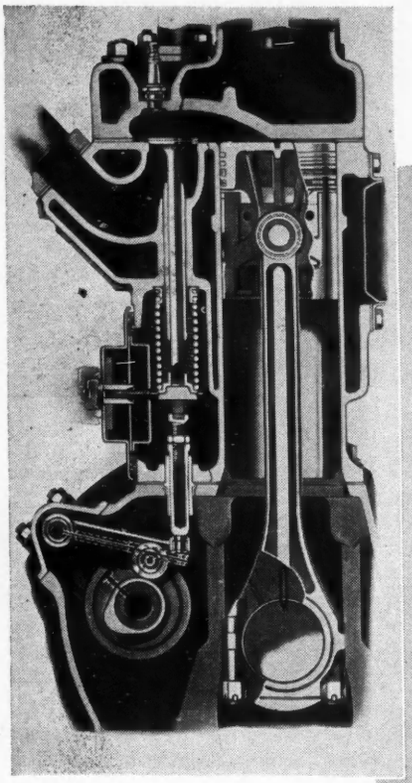
Bodies for the junior line are entirely of new, all-steel construction, with steel tops. There is ample room for three full-sized adults in both front and rear seats. As a matter of fact, the front seat is wider than the rear. The front seat is 48¼ in. wide, with 54⅜ in. of shoulder room; the rear seat, 47½ in. wide, with 56 in. shoulder room. Head room also has been increased, in the front compartment to 36 3/16 in.; in the rear compartment to 37⅛ in.

The new five-passenger coupe, as well as all other coupes in both the Packard Six and Packard Eight lines, has straight-across front seats with divided backs that tilt forward to permit easy access to the rear compartment. Doors are unusually wide to permit extra passengers to enter and leave easily without disturbing the front seat passenger.

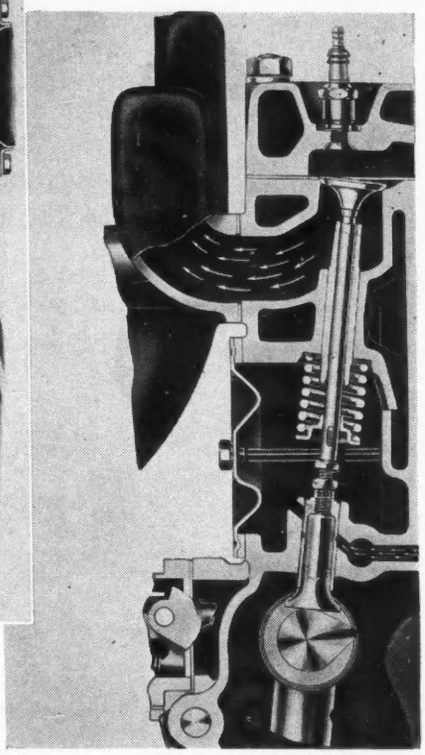
The new Packard Eight offers three choices of upholstery cloth—a new flat Bedford Cord, a plain all-wool broadcloth, and an all-wool snakeskin pattern broadcloth. The trim is also of the plain-tailored type, with multiple stitching risers on cushions, seat backs, back of front seat and on door panels.

Improved springs and padding are used in the seats of both new cars, assuring even greater riding ease, and new lounge-type arm rests have been designed for the rear compartment. Recessed ash receivers of the pull-out style are located in the front end of both rear compartment arm rests, a convenience for rear-seat passengers.

Upper front-door hinges are of the concealed type, disappearing in the cowl panel. Eleven types of insulating materials are used in the new bodies. Some of the detail is given below. The roof has a 1-in.-thick layer



(Left) Cross-section of Packard Super Eight engine showing long water jackets, added for 1938



(Right) Cross-section at valves, Packard Six and Eight engines, showing new valve lifter, new cam form, and pressure oil feed to the tappets

of sound-deadening insulation securely cemented to the steel; this also insulates the body against heat and cold.

Rear panels are insulated with a pad of the same material as used in the roof. Over the top of the wheelhousing an insulating compound is sprayed on heavily, and the sides of the housings have thick jute pads. Door panels are heavily sprayed with an asphaltic compound to prevent drumming. The cowl is lined with heavy jute, cemented in place with a permanent paste, and the toe boards are thickly covered with three different kinds of insulating material.

The floors of the front and rear compartments are insulated first with a layer of porous insulating material, on top of which there is a thick board of asphaltic compound, and both are then covered, in the front with a thick mat of durable corrugated rubber backed with a thick jute pad, and in the rear with a fine durable carpet also padded with jute.

Trunk sides are covered with printed jute for silencing and to give an attractive interior. The forward wall of the trunk, which is also the back of the rear seat, is covered with a slab of asphaltic compound and finished with a heavy layer of printed jute.

To complete the insulation against noise and vibration, the body is mounted on special mounting brackets which float the entire structure and prevent metal-to-metal contact.

The Super Eight has tuftless upholstery, with trim options of broadcloth or flat-weave Bedford cord. Both senior lines have new instruments and panel treatment. Interiors are new, with new body hardware, steering wheel and horn button. Defroster outlets are built into the windshield garnish molding and are served by a blower with twice the capacity of last year's model.

Composite body construction is continued on the senior line, with improvement in insulation against heat, cold, and sound.

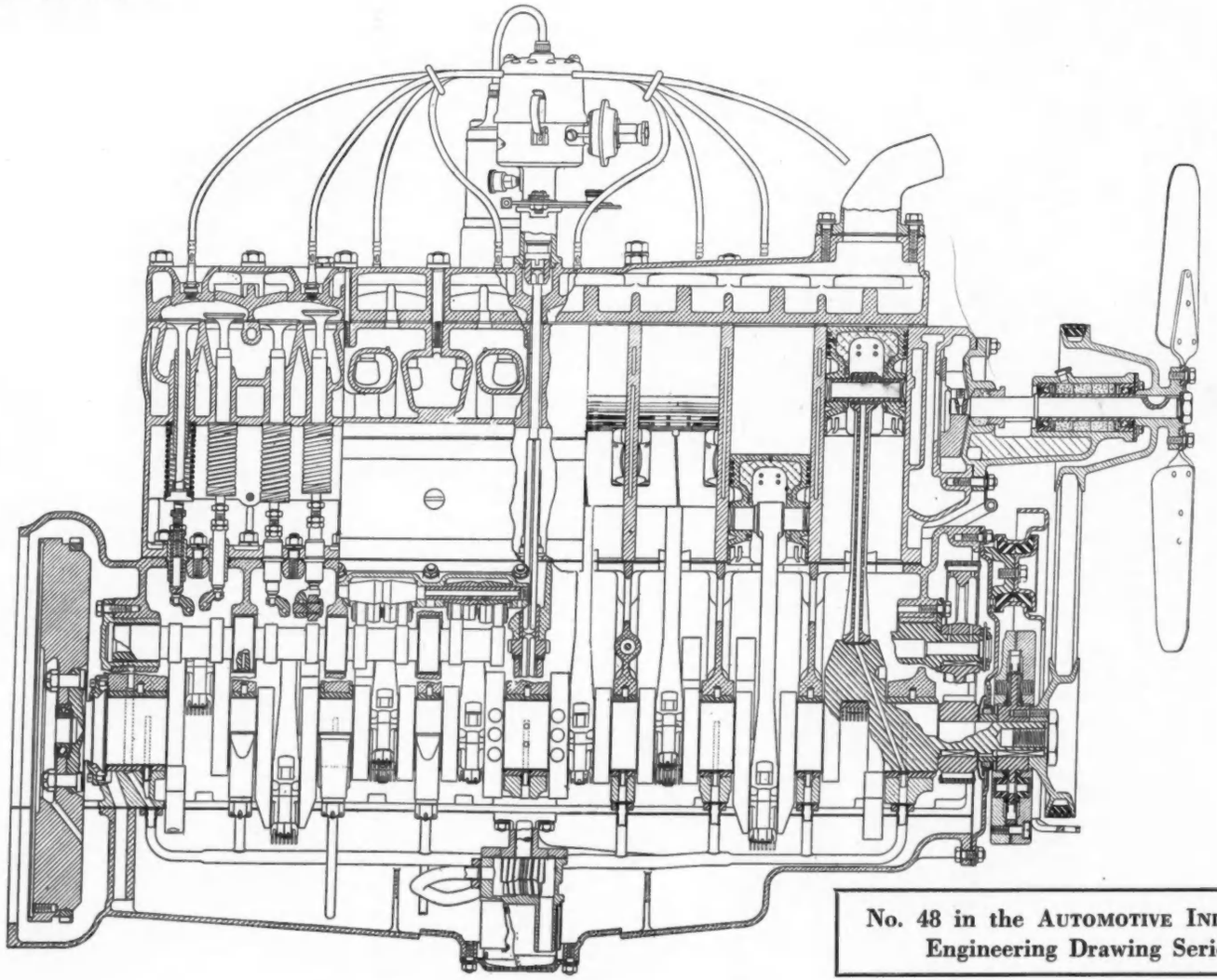
Headlighting has been improved on all lines. Four different lighting beams are provided in the new Packard Six and Eight. When the control button is pulled out to the first notch, parking lights and tail lamps are lighted; when it is pulled to the second notch, city driving beams are turned on and adequate illumination without glare is provided. If, when the city driving beams are in use, the toe button to the left of the clutch pedal is depressed, the country driving beams are turned on. Third, with the control button pulled all the way out the powerful, long-distance, country-driving beams come into play. These country-driving beams provide brilliant illumination of the highway far ahead and, as well, give lateral lighting for curves, etc. The fourth beam is the country passing beam. When approaching another car to within 500 ft. the toe button on the floorboard is pressed and the left hand headlamp beam is depressed so that there is no glare in the oncoming motorist's eyes. At the same time the right hand side of the road is fully lighted.

On the senior line, all beam positions are indicated by illuminated tell-tales on the faces of ammeter and oil gage as previously. The light switch remains as before, except for the function of the toe switch.

In addition to the standard models available on the Eight chassis, Packard offers the Eight sedan and limousine for eight passengers on a 148-in. wheelbase chassis. The larger chassis has a rear-wheel tread of 62½ in. to accommodate a wider body. It has a heavier rear axle, heavier frame, heavier rear springs, and front springing of greater load capacity. The propeller shaft is provided with an intermediate, self-aligning bearing. The rear axle ratio is 4.7, while tire equipment is 7.00 by 16 in., six-ply.

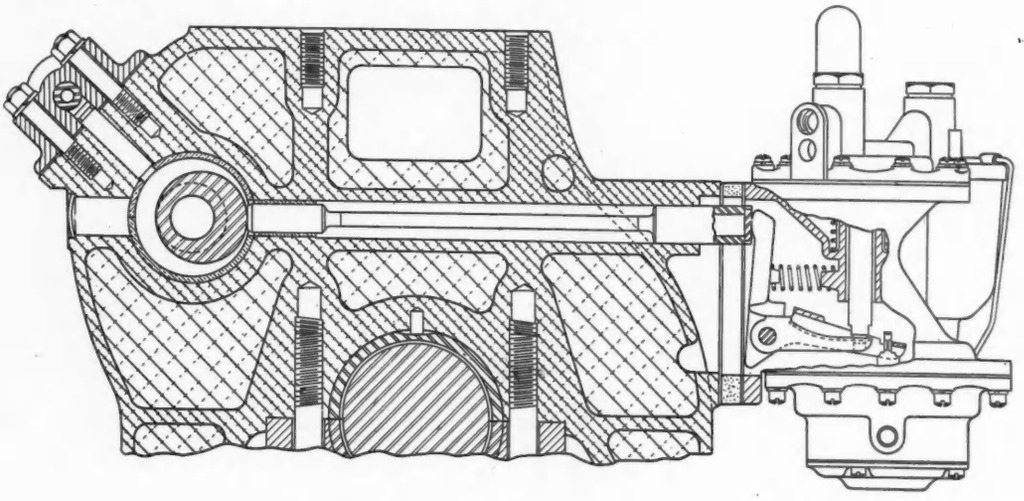
On the two following pages are engineering drawings of the Packard Engine

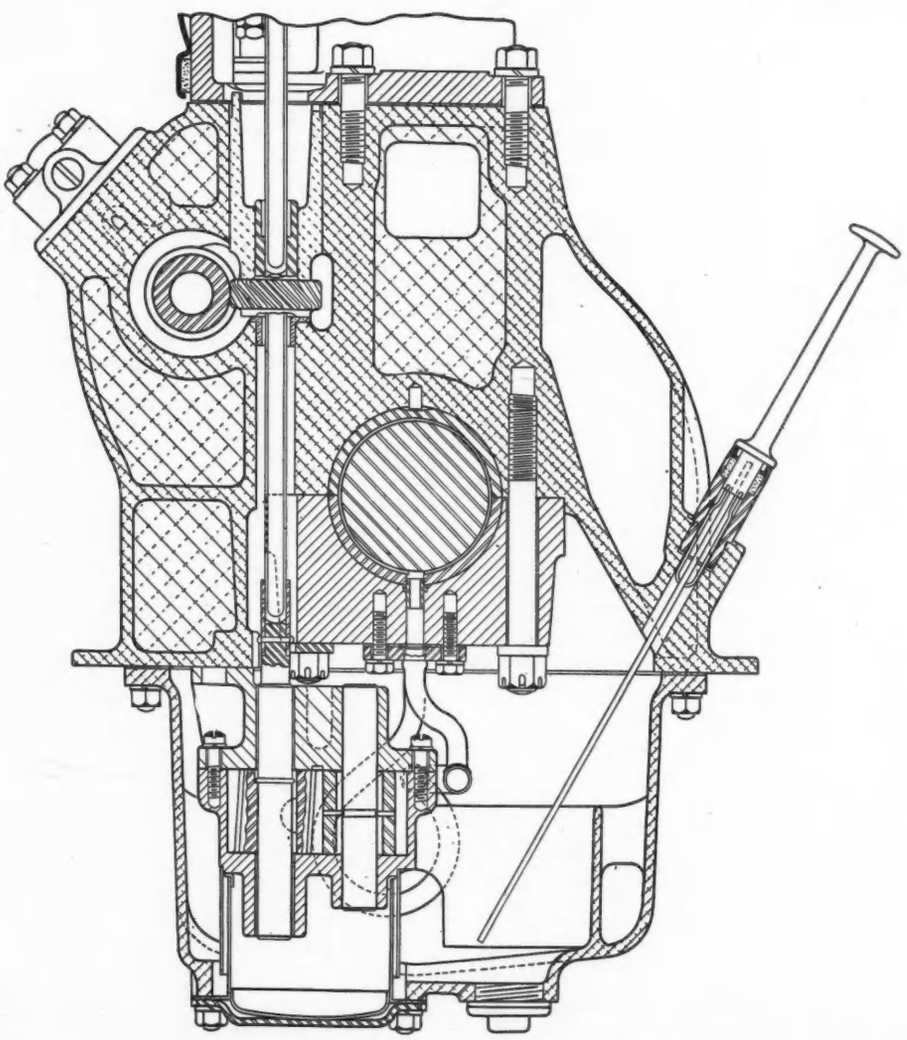
1938 PACKARD SUPER EIGHT . . . *passenger car engine with 3 3/16-in. bore and 5-in. stroke, making the piston displacement 320 cu. in. It is rated 135 hp. at 3200 r.p.m. Compression ratio is 6.5 to 1.*



No. 48 in the AUTOMOTIVE INDUSTRIES Engineering Drawing Series.

PACKARD . . . *Super Eight transverse sectional views of the engine which are reproduced to twice the scale of the longitudinal view shown on the preceding page.*





Lubricating Hypoids in the Lower Price Brackets

SPEAKING at the Fuels and Lubricants Regional Meeting of the S.A.E. at Tulsa, on Lubrication Experience with Hypoids in the Low-Price Brackets, R. K. Floyd said that one large automobile company which changed to hypoids a year ago, fully realized the dangers involved in such a radical change and acted with corresponding care, as regards both manufacturing methods and original factory lubrication. This company groups its complaints under different headings and rates the causes of complaints according to their order of frequency. Axles formerly were among the ten most prolific sources of trouble, but since hypoids were adopted axle complaints had shrunk to a very low figure.

According to Mr. Floyd, during the fall of 1936 there were no hypoid gear lubricants generally available to the public, but by the spring of 1937 two hundred approved hypoid lubricants were on the market in the United States, and obtainable also in other parts of the civilized world with the exception of Russia. He felt the oil and automotive industries might well congratulate themselves on the efficient way in which their joint program had been carried out to date.

The problem that remained was to get owners to pay proper attention to the lubrication requirements of these axles, and it must be realized that lubrication control was much more difficult in connection with low-priced automobiles than with cars in the higher-priced brackets. A recent limited survey had shown that up to that time only about 10 per cent of the 1937 models equipped with hypoids had been in for axle change and refill, and the author expressed the opinion that if this figure held for the whole country, much remained to be done by way of demonstrating lubrication control.

Climatic Studies and Lubricating Problems

RESULTS of a volatility survey of gasolines marketed in the Mississippi Valley during the last two and a half years were given in a paper by R. C. Alden and D. C. Proudfoot of Phillips Petroleum Co. House-brand gasolines continue to show the highest vapor pressure, premium gasoline coming next, and third-grade gasoline last. The difference in volatility between the three grades is much greater in winter than in summer. The surveys made during the past two years and a half are a continuation of work carried on since 1929, and taking the results of the entire series, it can be stated that there has been little change in the seasonal "front-end" volatility but that motor fuel now shows somewhat higher vapor pressure.

As regards the 50 per cent point for housebrand gasolines, that of winter gasoline has been rapidly decreasing, while that of summer gasoline has been slowly increasing, the average midpoints in the district covered having been 222 deg. for winter gasoline and 244 deg. for the summer grade in 1936.

As compared with housebrand gasolines, premium grades have an increasingly lower 50 per cent point and third-grade gasolines a considerably higher one.

Another feature of the paper was an attempt by the authors to apply results of climatic studies to lubrication-ser-

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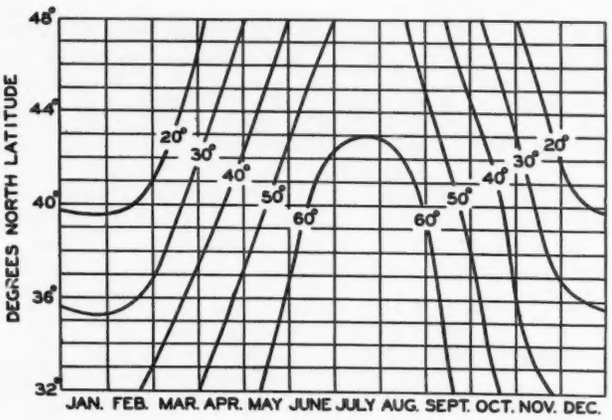

Fig. 1—Compensation for Elevation

$$C = \frac{A + 3.06\,(E-2)}{1 + 0.0345\,(E-2)}, \text{ Where}$$

C = Sea Level Latitude Corresponding to Elevation.
A = Latitude at Elev.
E = Elev. in Thousands of Feet.

Annual Mean Min. Temp. Cycles for the Mid-Continent. (Latitude—Central Texas to Canadian Line).

vice problems. Long-time weather records of the U. S. Weather Bureau were used, and the monthly mean minimum temperatures of the reporting stations were plotted with respect to latitude and time. The mean minimum figures were chosen because of the importance of viscosity in cold starting. From the points plotted, a family of curves (Fig. 1) were drawn by means of which the mean minimum temperature could be determined for any location at any time of the year.

To determine the probable extreme range that would be encountered at various mean minimum temperatures, the monthly mean maximum and the monthly highest and lowest on record were plotted (Fig. 2), with the monthly mean minimum as the abscissa. The zones represent variations with localities. This in conjunction with Fig. 1 ties in the complete temperature ranges with time. For example, when the mean minimum is 20 deg. Fahr. the average lowest on record is —10 deg. Fahr. and the mean maximum is +50 deg. Fahr., essentially the range specified for the use of 10W. By reference to Fig. 1 it can be determined with reasonable accuracy just when this may be expected at any point in the geographical area under consideration. At high altitudes atmospheric temperatures are markedly lower than for sea level points of the same latitude. By formula on Fig. 1 it is possible to determine the sea level latitude whose seasonal minimum temperatures correspond with those of a certain altitude and latitude. For in-

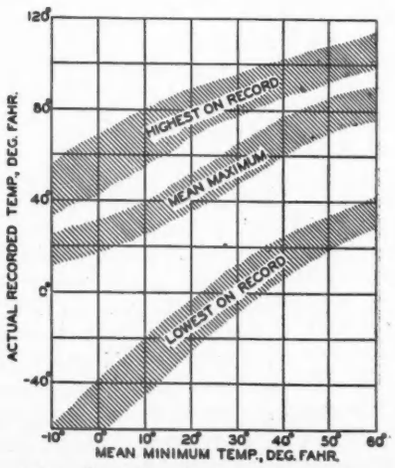

Fig. 2—Correlation of extreme temperature data with mean minimum.

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stance, territory at 6000 ft. elevation and 40 deg. latitude has the same seasonal temperatures as sea level territory (which includes everything up to 2000 ft. elevation) at 45.9 deg. latitude.

To make these data useful, the area covered by the survey (the Mississippi drainage basin) was divided into four so-called weather zones, the contours of which were determined from Fig. 1. By the use of Figs. 1 and 2 the dates between which oils of different viscosity number should be used in engines can be put on a calendar basis in many different forms.

Properties of Hydrocarbons

AT a symposium on the characteristic properties of hydrocarbons and their derivatives as related to molecular structure, held by the Division of Petroleum Chemistry at the recent meeting of the American Chemical Society in Rochester, N. Y., Frederick D. Rossini of the National Bureau of Standards presented a paper dealing with the evaluation of heats of formation; the existing thermochemical data on the simple molecules (with from one to six or seven carbon atoms) of the various classes (paraffin hydrocarbons, olefin hydrocarbons, naphthene or cycloparaffin hydrocarbons, aromatic hydrocarbons, alcohols, ethers, ketones, aldehydes, acids, amines, cyanides or nitriles, sulfur compounds, and halogen compounds); bond energies and "atomic" heats of formation; and regularities in the heats of formation.

Within the past 15 years, the simpler organic molecules have assumed an importance of new magnitude in the chemical and petroleum industries, where they are being treated in many different types of reactions (such as addition, polymerization, oxidation, hydration or dehydration, hydrogenation or dehydrogenation, and decomposition "cracking") to produce, on a large scale, molecules hitherto available only in the laboratory. In the petroleum industry, especially, some of the above reactions are being prosecuted on a large scale to produce superior fuels for internal-combustion engines in quantities which are increasing almost geometrically.

After the first rush of success in any virgin field of endeavor, the increase of competition makes necessary greater economy in operation and higher efficiency in processing methods. Inquiry must then be made as to whether the chemical reactions involved in the given processes are being carried on under conditions which will insure the greatest economy and highest yield. Given an appropriate catalyst, the question as to whether the reaction will proceed at all in the desired direction, and to what extent, under given conditions of temperature and pressure, can be answered by the empirical and costly methods of trial and error or by simple constants of the substances involved. calculations from the thermodynamic One of the most important factors in this latter calculation is the heat of the given reaction; and an accurate value for this must be known to obtain a reliable thermodynamic analysis of the process.

Another value of data on heats of formation lies in the more fundamental question of the energies of the atomic linkages in these molecules—the energy of binding which keep atoms together in certain preferred structural relationships. These bond energies are important in the calculation of energies of activation and rates of reaction, which yield information concerning the "mechanism" of given reactions. While certain other data are also required in evaluating bond energies, the heats of formation is the keystone in the calculation.

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It's a REAL JOB—this keeping up with the Johanssons out at the Ford plant in Dearborn. The cost of it runs into big figures. And thereby hangs a tale, for the Johanssons in this case aren't the neighbors—they're gage blocks.

Johansson Gage Blocks maintain the standards set for precision manufacturing. The big Rouge plant couldn't begin to hold the accuracy specified for Ford parts without its "Jo Blocks." Ford quantity production isn't haste, pressure and confusion. It's progress, order—scrupulous precision.

It all goes back to a carefully insulated underground room in the Ford plant where constant temperature is maintained. Here are kept the master sets of Johansson Gage Blocks—the magic that makes possible modern quantity production that's extremely accurate.

Johansson Gages, made in the Ford plant, are supplied to many other manufacturing plants and laboratories where maximum accuracy is essential. These polished blocks of steel in the laboratory sets are accurate within two-millionths of an inch.

Measurements in thousandths and in ten-thousandths of an inch are extremely common in Ford manufacturing. Even some of the Ford automatic inspection machines have a gaging accuracy of one ten-thousandth of an inch.

And so "highest manufacturing accuracy" is more than a slogan or byword at the Ford plant. It explains Ford success in quantity production—and the fact that today the Ford V-8 is THE QUALITY CAR IN THE LOW-PRICE FIELD.

Ford

FORD MOTOR COMPANY